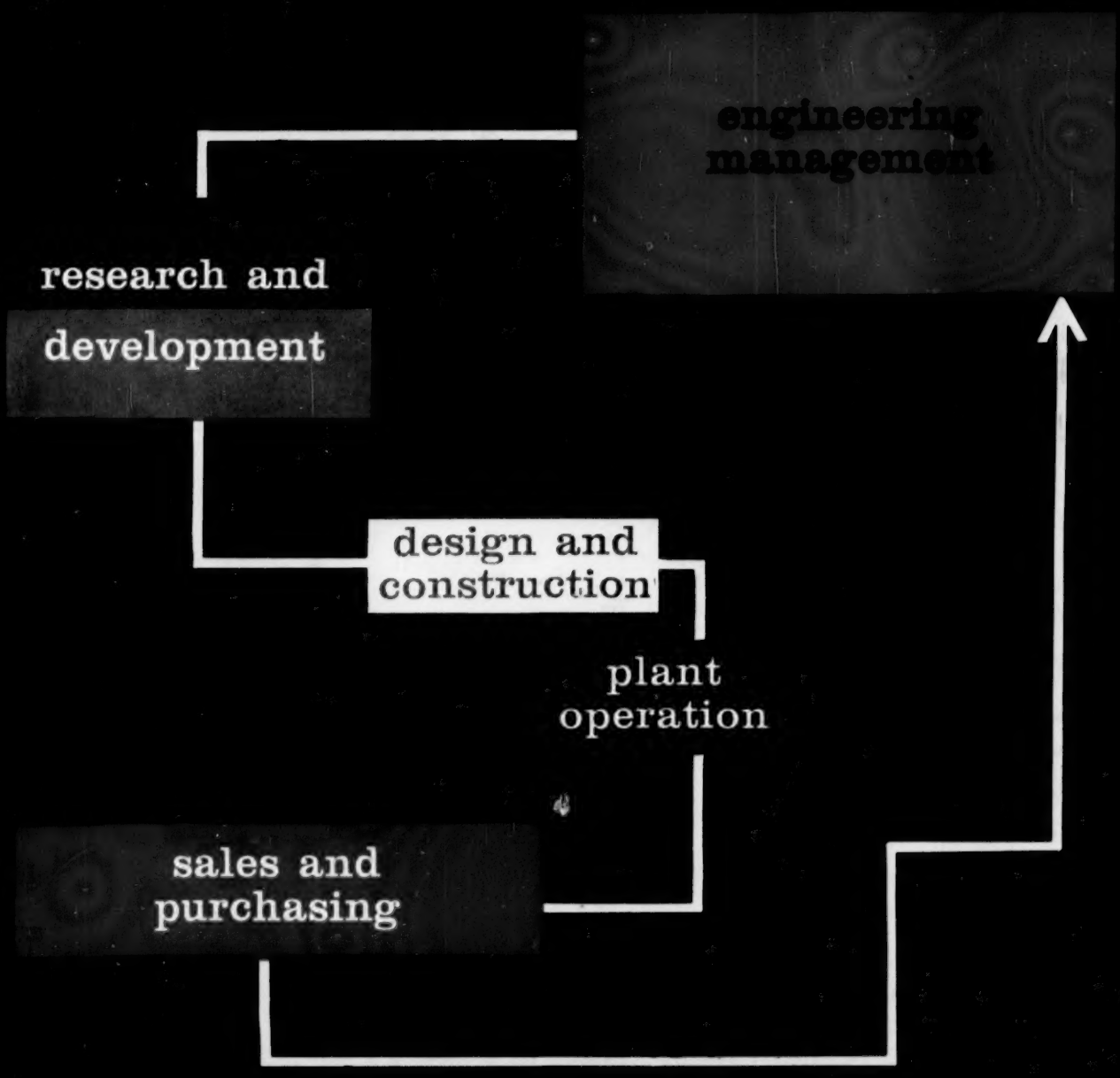
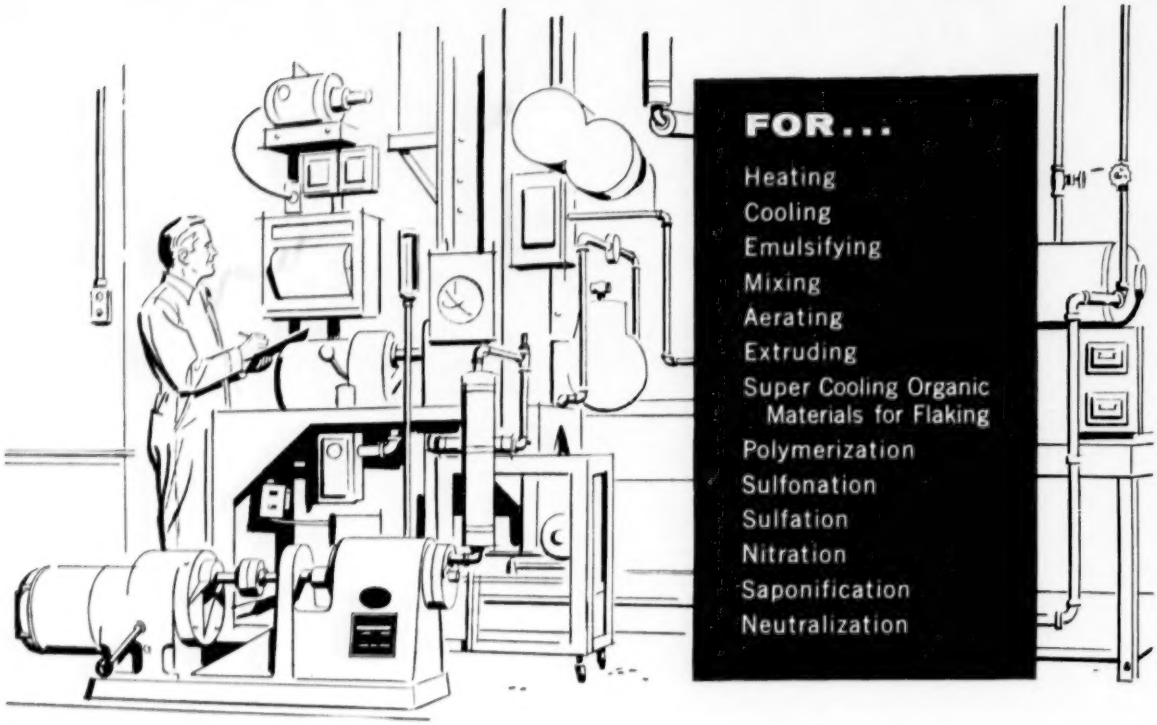
Chemical Engineering

A McGRAW-HILL PUBLICATION
ONE DOLLAR

SEPTEMBER 1957

HOW TO SPEED THE FLOW OF INFORMATION...



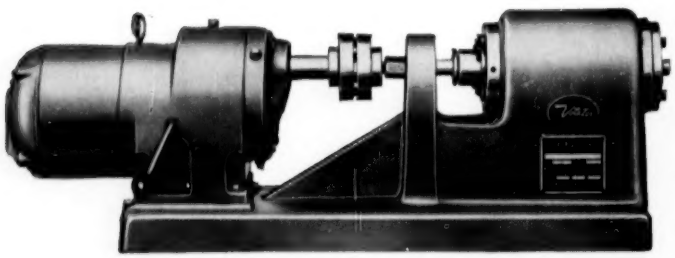


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SEPTEMBER 1957

JOHN R. CALLAHAM, Editor-in-Chief

From Idea to Article . . .

. . . may take anywhere from days to years. It all depends . . .

▶ **Days** — Vital news is always rushed into print. If it's big enough, we change our schedule to get it in. You'll find most of our last-minute news in *Chementator.*

▶ **Weeks**—Most stories in our Developments section take several weeks to get into print. Reason: We dig deeper for more data, check facts, pry into meaning, repeatedly ask why and how. That takes time—time that weekly publications can seldom take.

▶ **Months**—The story on continuous hexamine (p. 156) took close to three months. We got wind of it by accident, spent months tracking down the facts. Result: The first process news in the U. S. on this German development.

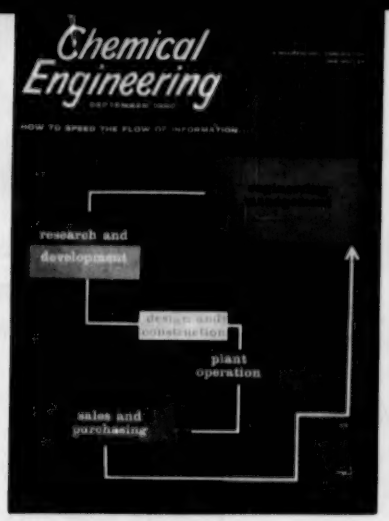
Or take the article on cost of conveyor belts (p. 242). Author Mills sent it to us last March. Each of the five engineers in our Practice group reviewed it critically, asked questions, suggested more data. From then on it was easy to prepare the exclusive article you see today.

▶ **Years**—Often we trail an idea for years before you see it in print.

Four years ago we got wind of obscure, but promising, research on high-temperature chlorination. Slowly we filled in the bits and pieces, watched progress, waited for the right timing. On p. 170 you'll find the story: A technological advance detailed for the first time in this issue of CE.

Or take this month's report on flowsheets (p. 249). We kicked this idea around for years. Five years ago we thought we had an author; after a long, hard look he backed out. Several other efforts fizzled.

Over a year ago we contacted consultant O'Donnell. After 11 meetings with his staff, O'Donnell threshed out the contents and approach. We agreed. Result: This month's 18-page report—a "first" in the field.



GUIDED TOUR

How to make engineering information flow to and from all levels

All flowsheets have a single purpose: to communicate engineering information. They're used to tell many things to many people for many purposes. There's no end to their usefulness as transmitters of vital data. Hence our review. It will spur your thinking as to their myriad applications in the chemical process industries. (p. 249)

What's what with particle accelerators

No longer are ionizing radiations exclusively a research tool. New applications are being commercialized, so here's a run-down on their position today—their production, use and economics. (p. 235)

Accurate conveyor cost estimates

Not only is there a better way of estimating today's belt conveyor costs, it also will

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be good tomorrow and next year because it's correctable for changing economic conditions. (p. 242)

When you're buying

Don't forget what income taxes can do to the amount you can afford to spend, and to the service life your purchase should have. Here's an extension of the concept of capitalized costs. (p. 271)

Saying things in mathematics

How to set up the necessary math for material balances and heat transfer. First in a new series of CE Refresher articles that'll brush up your math and help you in your work. (p. 284)

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Don't take another business trip before you find out how to enjoy work while on the road. Answers (ethical, legitimate and moral) all your away-from-home business and personal problems. (p. 321)

CE is edited for the engineer concerned with chemical operations, whatever his function . . . administration, production and plant operations, design and construction, research and development, sales and purchasing. More engineers subscribe to CE than to any other magazine in the field. Print order of this issue:

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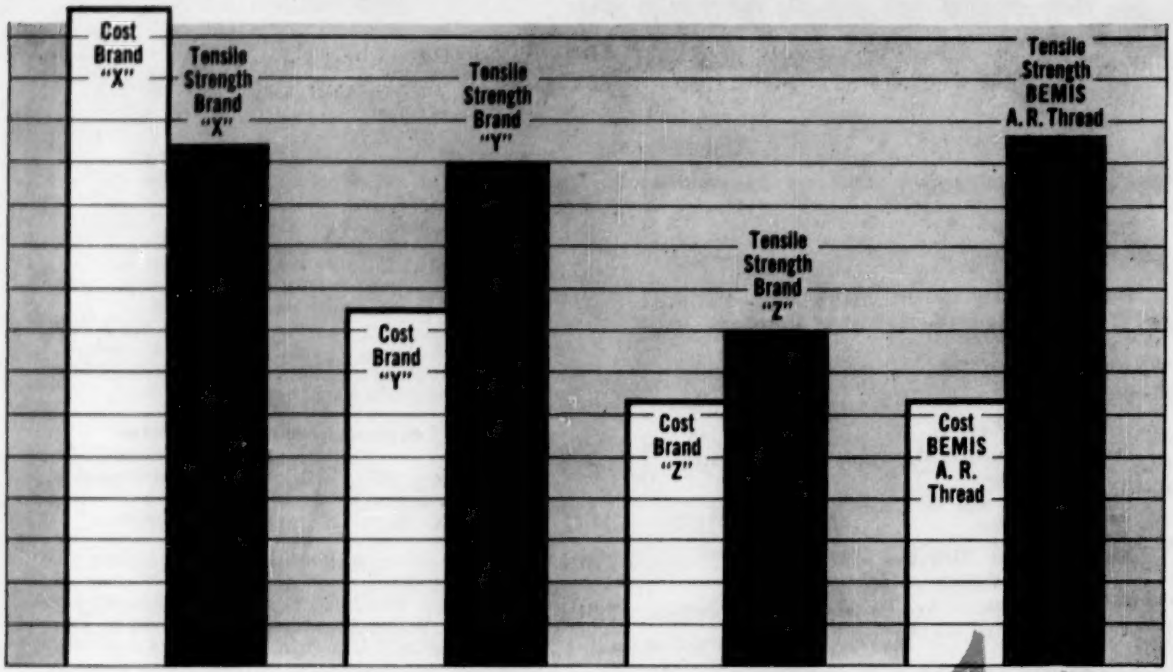
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coverage of petrochemicals and petroleum refining in our next issue.

Report on BEMIS Acid-Resistant Thread:



LOWEST COST
HIGHEST STRENGTH
AFTER SEVERE TEST

When your multiwall bags are made and closed with BEMIS Acid-Resistant Thread you're giving your customers the best packaging — and it costs less

Here's proof of the exceptional value you get from Bemis Multiwalls, made and closed with Bemis Acid-Resistant Thread . . .

An interested, independent, outside organization* conducted rigorous tests with four well-known industrial threads — Bemis Acid-Resistant Thread, a widely used synthetic filament thread, and two other competing threads.

Two samples of each thread were buried in triple superphosphate (0-45-0). One set of samples was placed in a high-humidity room (100°, 90% R. H.) openly exposed. A second set was kept under more normal conditions (73°, 50% R. H.).

After *twelve weeks* in the superphosphate, the samples were removed and tested for tensile strength. Bemis Acid-Resistant Thread and the synthetic filament (long considered to set the top standard) came out with almost exactly the same score . . . and both were substantially ahead of the other two threads.

But here's the payoff—Bemis Acid-Resistant Thread costs *less than half* as much as the only other thread that equalled it in performance. (Incidentally, it performs in sewing machines just like the famous Bemis Special Thread.)

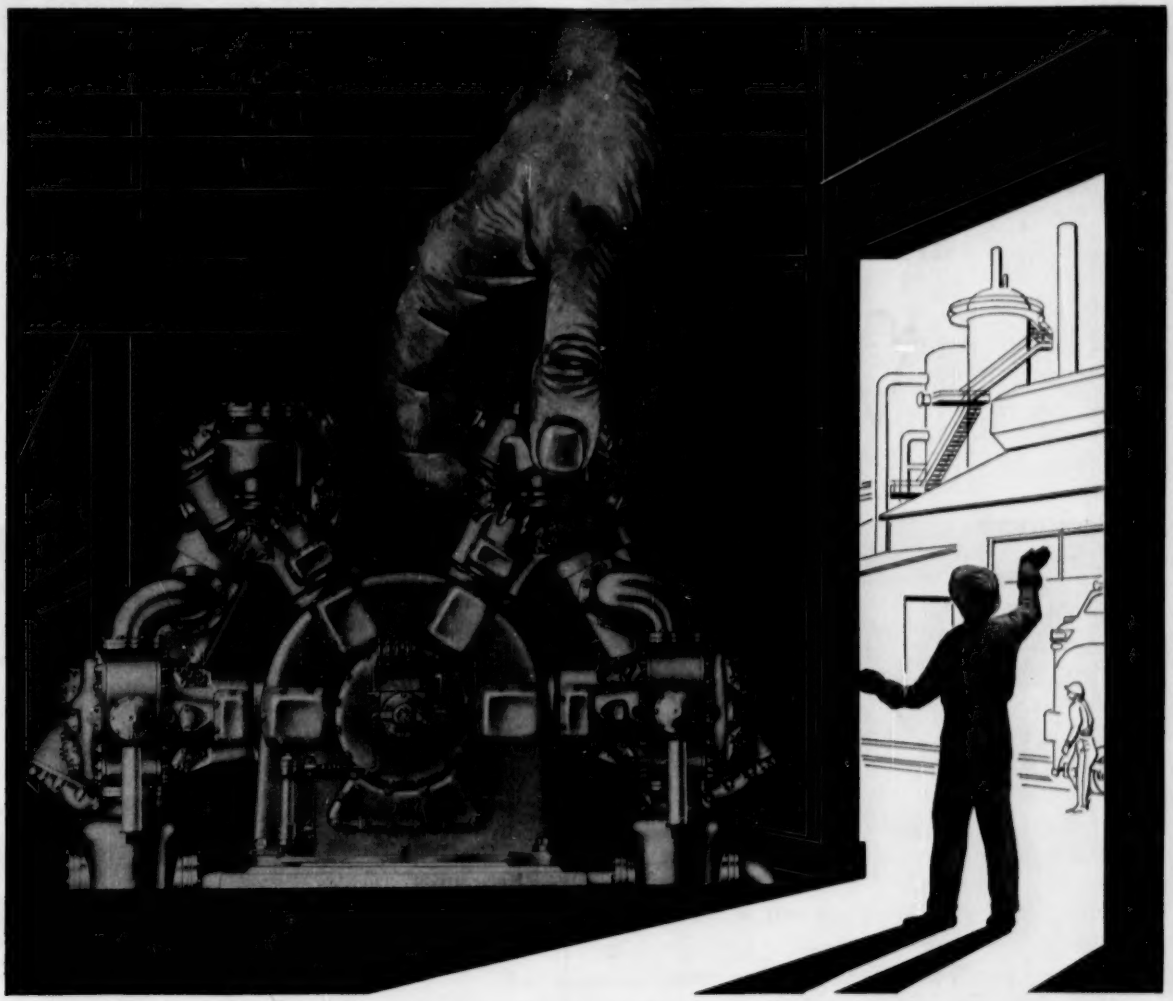
Naturally, you're going to get the best economy, performance *and value* when you use Bemis Multiwalls, made and closed with Bemis Acid-Resistant Thread. And it is *alkali-resistant* as well.

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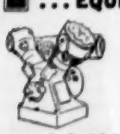
AND THE WN-224 SOLVES YOUR SPACE PROBLEMS . . . it can be installed where no other compressor of equal capacity will fit. Instead of long, horizontal units on massive foundations, the Joy WN-224 has four cylinders arranged semi-radially around the frame. This compact, balanced arrangement assures smoother running, gives longer service with far less maintenance. Get the whole story on the WN-224 from ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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Industrial Compressors



Conveyors



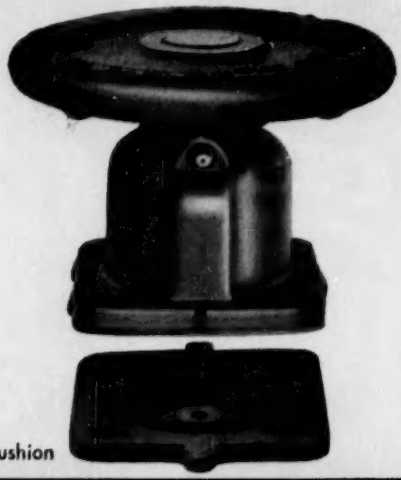
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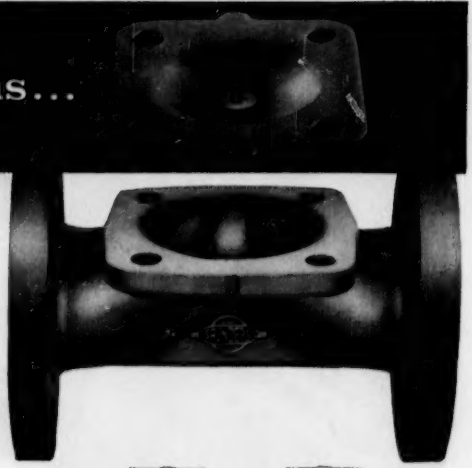
Fans and Blowers

Outperforms other valves under SEVERE chemical conditions

GRINNELL-SAUNDERS DIAPHRAGM VALVES



with TEFLON Diaphragms...

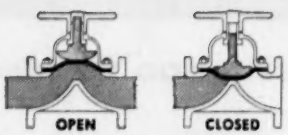


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The four case histories cited below demonstrate that Teflon offers a very high degree of chemical inertness to some of the most difficult chemicals which industry today must handle. Yet these are only a few of many success stories in the Grinnell files.

Diaphragm life depends on temperature, pressure and frequency of operation. Inquiries must include complete service data to receive prompt and careful attention.

Service Conditions	Saunders Valve	Service Life: Teflon	Service Life: Previous Material
Case 1. Benzene hexachloride (30%-40% benzene, free chlorine); 120 to 130 F, 10 to 20 psi; operated 3 to 4 times daily	Glass lined bodies; Teflon Diaphragm; 1 to 3 inches	10 to 14 mos.	1 to 2 mos.
Case 2. 90%-95% HNO_3 plus 1.8% HF (specific gravity 1.62–1.77) 115 F in summer; 40 F in winter; 125 psi; operated 2 to 3 times daily	Durimet 20 body; Teflon Diaphragm; 1 to 3 inches	8 months	2 months
Case 3. $AlCl_3$ complex; ambient to 220 F; 0-50 psi; operated 1 to 2 times daily	Glass lined bodies; Teflon Diaphragms; 1 to 4 inches	9 months	6 months
Case 4. Sulphuric acid 85%; outside temperature; no pressure; operated 4 times daily	Iron bodies; Teflon Diaphragms; 2½ inches	Still in service after 1 year	3 weeks



Features of Grinnell-Saunders Diaphragm Valves

- Diaphragm lifts high for streamline flow in either direction.
- Body, linings and diaphragm materials to suit service conditions.
- Resilient diaphragm assures positive, leak-tight closure even with grit or scale in the line.
- Diaphragm absolutely isolates working parts from fluid . . . sticking, clogging, contamination, corrosion eliminated.
- Simple maintenance. Diaphragm can be replaced easily without removing valve from the line. No packing glands to demand attention. No metal-to-metal seats to become damaged or wire-drawn.

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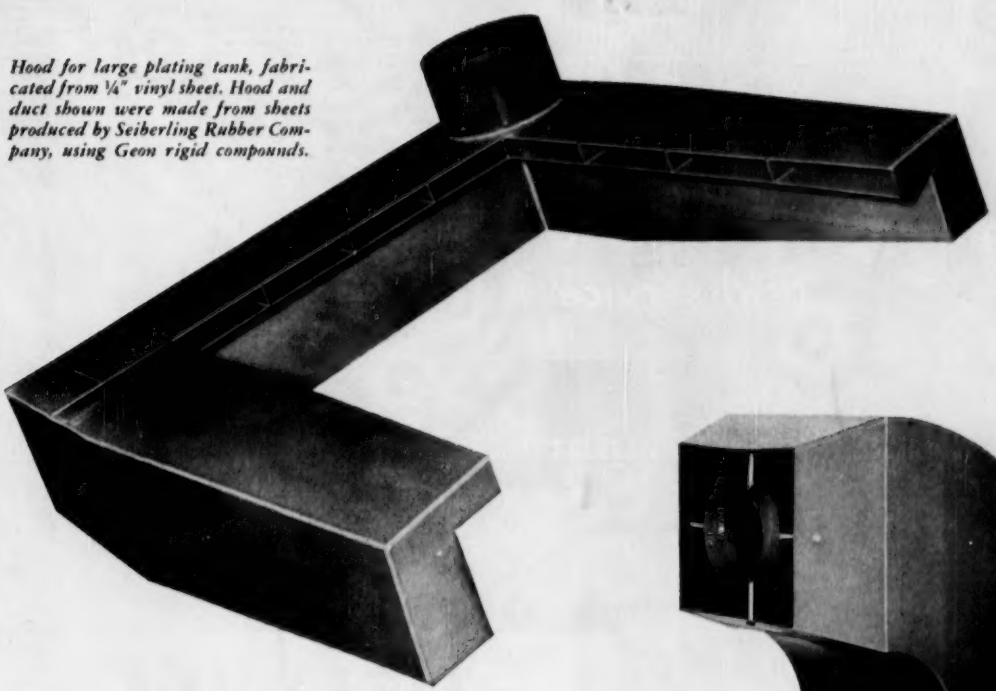
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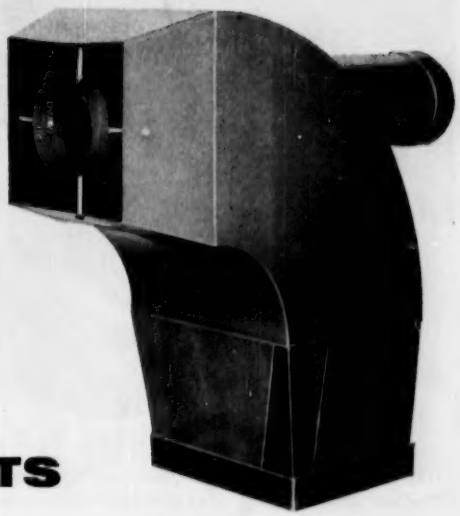
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Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

News about

B.F.Goodrich Chemical *raw materials*



Hood for large plating tank, fabricated from ¼" vinyl sheet. Hood and duct shown were made from sheets produced by Seiberling Rubber Company, using Geon rigid compounds.



Fume duct fabricated from ⅜" vinyl sheets.

GEON RIGID VINYL DUCTS

carry away corrosion problems

WITH ducts, hoods, fans and fume stacks now being fabricated from rigid sheets made from Geon polyvinyl compounds, you can eliminate many corrosion replacement problems.

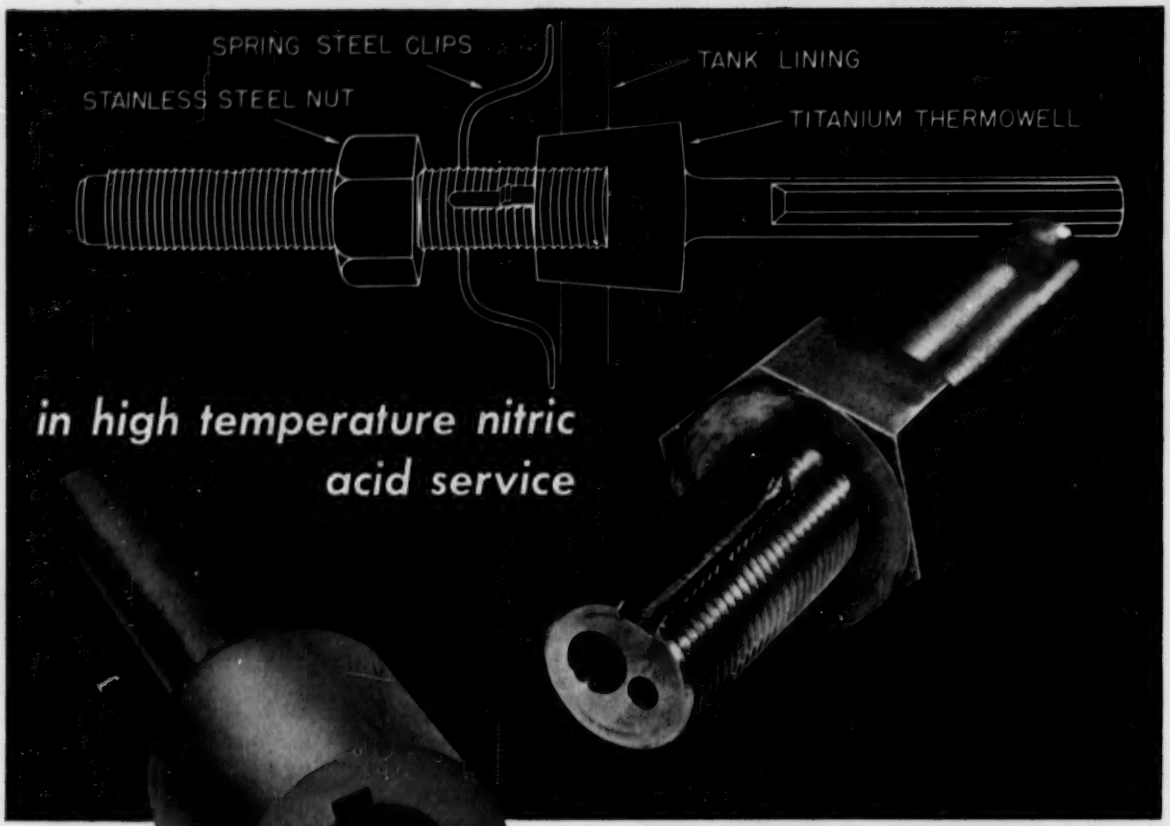
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For booklet on properties of rigid Geon resins and compounds write Dept. FH-7, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



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TITANIUM
thermowell SAVES $10,000

A thermowell, used in a chemical reaction vessel at DuPont, was failing about every nine months from severe corrosion, even when fabricated from one of the best of the standard corrosion-resistant metals. The environment was dilute nitric acid and nitrogen oxide at temperatures exceeding 400F.

Titanium was suggested as a material of construction. But, since such a unit would cost $300 against $95 for the existing installation, a careful total cost analysis was made. The findings were startling:

DuPont corrosion engineers discovered that each time a thermowell failed, it cost the company $1500 in lost production and replacement labor. They estimated a service life for the titanium thermowell of at least five years (five to ten times as long as stainless) resulting in a saving of about $10,000.

As this case history shows, titanium's corrosion-resistance often makes it by far the most economical material. Yet, this versatile metal offers additional outstanding advantages . . . each sufficiently important to recommend it to designers and engineers. For example, titanium is unusually resistant to erosion by high-velocity fluids and to stress-corrosion cracking . . . withstands abrasion, shock and fatigue . . . has a uniquely high strength-weight ratio that means substantial reduction in weight and cost of material needed for a given use.

When the going is tough for ordinary metals – try REM-CRU titanium. For specific recommendations, call or write REM-CRU today.

Write Dept. C9 for the Rem-Cru Review—a free periodical presenting the latest data on titanium.

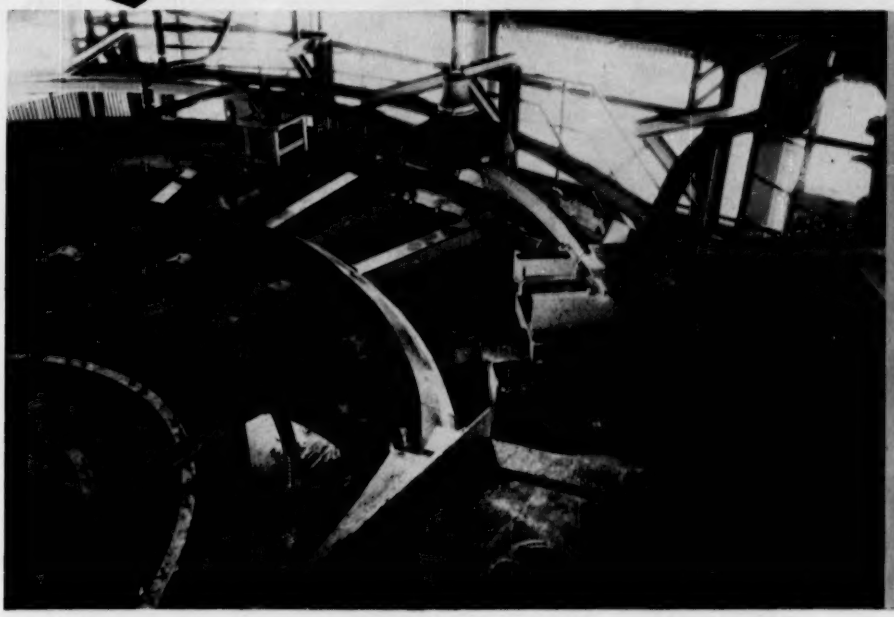
REM-CRU TITANIUM

World's Most Versatile Metal

Sales Offices: 3338 South Malt Avenue, Los Angeles 22, California • 4501 W. Cortland Street, Chicago 39, Illinois • 405 Lexington Avenue, New York 17, N. Y.

U.S.I. CHEMICALS goes on-stream with new "Wet Process" Phosphoric Acid Plant using unmodified "spent" sulfuric acid.

Bird-Prayon Tilting Pan Vacuum Filter helps maintain 24 hour per day production without frequent interruptions for filter maintenance.



Here is the Bird-Prayon Filter on the job at Tuscola, Illinois. This plant, designed and built by Singmaster & Breyer using the Prayon Process, achieves significant economies. It utilizes "spent" acid and realizes high P_2O_5 recoveries with the Bird-Prayon Filter which is used in the heart of the process.

How about your Filtration problem?

Whenever you are faced with any of the following conditions, the Bird-Prayon Filter will improve your profit picture.

EFFICIENT WASHING A NECESSITY

Whether your product is the cake or the filtrate, higher washing efficiencies are obtained regardless of quantity of wash liquors employed.

"HARD TO HANDLE" SOLIDS

Rapid settling solids fall on the filter cloth. Abrasive solids fall off when the pans are inverted for discharge.

FILTER CLOTH "BLINDING"

Continuous automatic washing of cloth between cycles removes residual cake and dissolves scale.

COST AND VOLUME OF WASH LIQUOR — CRITICAL

Multiple stage, countercurrent washing will reduce wash liquor requirements to a minimum. Evaporation costs are lower, Circuit dilution is avoided.

BIRD

MACHINE COMPANY

Builders of

- Bird Continuous Centrifugal Filters
- Bird-Prayon Continuous, Rotary, Horizontal Vacuum Filters
- Bird-Young Continuous Rotary Vacuum Filters
- Bird Horizontal Tank, Vertical Leaf Pressure Filters
- Bird-Humboldt Screen Type Centrifugal Dryers
- Bird Suspended Centrifugals • Bird Centrifugal Classifiers
- Bird Continuous Centrifugal Coal Filters • Bird Polishers
- Bird Centrisweeps for delicate Crystals, Fibrous Materials

For specific information on individual machines write:

BIRD MACHINE COMPANY

South Walpole, Mass.

Regional Offices:

Evanston, Illinois

Portland, Oregon





Space-saving feature of the right-angle Cleveland Worm Gear drive is well illustrated here. Note how reducer and motor literally hug the driven machine

CLEVELAND drives Swift single-facer at uniform high speed

THIS famous single-facer has many exclusive improvements and advantages which mean much to the corrugated box-maker. Scientifically designed and ruggedly built, it turns out single-faced corrugated board at speeds up to 700 feet per minute.

Driving this machine is a heavy-duty Cleveland Worm Gear Speed Reducer. It connects the motor directly with the bottom corrugating roll. Hydraulic units provide pressure loading of the pressure roll and top corrugating roll. The result is high output of board of maximum strength and rigidity.

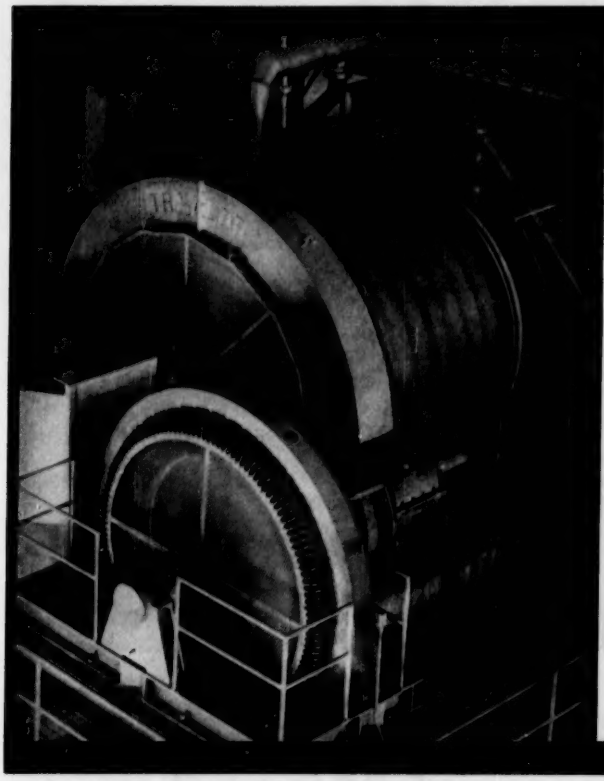
Clevelands are designed for the tough jobs—wherever the demand is for dependable performance under difficult conditions or continuous service for extra-long periods. So specify and use Clevelands on *your* machines. Get Bulletin 145 for engineering data and descriptions of all models. Write today—it's free. The Cleveland Worm & Gear Company, 3275 E. 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers, Limited.

CLEVELAND Drives

the big league ball player has his equipment custom-made because he gets something **EXTRA**





the profit-wise operator

BUYS TRAYLOR BALL MILLS for the same reason

Leading producers rely on the proven features of Traylor-made Mills to achieve EXTRA production efficiency and lower operating costs.

Available in sizes to meet practically every requirement, Traylor Grinding Mills are offered in a wide variety of types including: Ball, Rod, Compartment and Tube Mills for wet or dry . . . coarse or fine grinding. Write for Bulletin No. 11-121

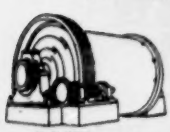
TRAYLOR ENGINEERING & MFG. CO.
1920 MILL ST., ALLENTOWN, PA.
Sales Offices: New York—Chicago—San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

the experts agree . . . there's nothing like

TRAYLOR-MADE

equipment for peak performance

Traylor


Ball Mills

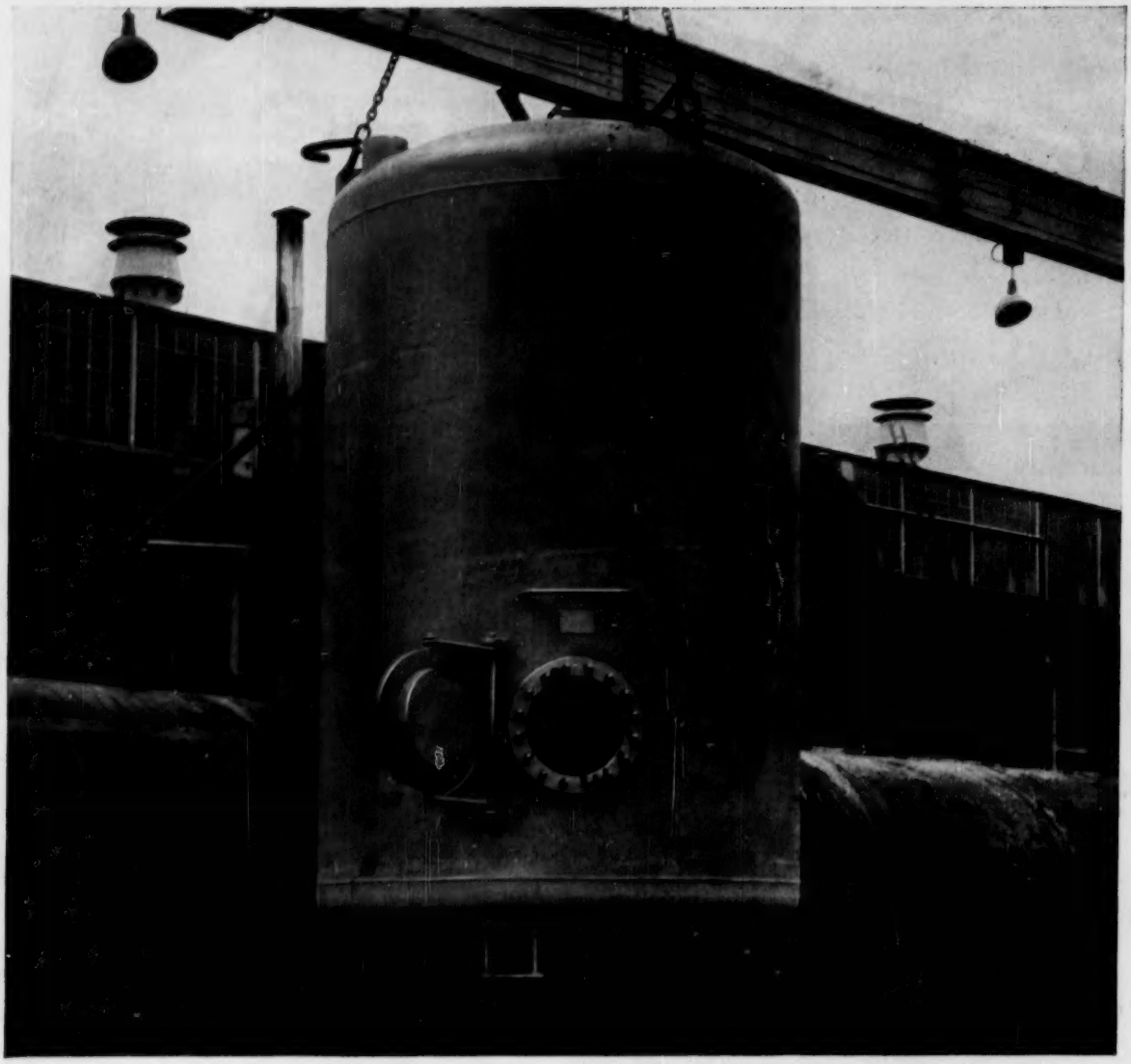

Rotary Kilns


Primary Gyratory Crushers


Apron Feeders


Jaw Crushers


Secondary Gyratory Crushers



A decade of repeat orders... to the tune of 330 tanks

The only thing unusual about this tank is that it is one of 330 units made at Downingtown to the same basic design specifications.

It measures 8′ in diameter and 12′ high. Material is carbon steel. Interior welds are ground flush and smooth. Operating pressures are nominal.

But the tank represents customer satisfaction with Downingtown workmanship, delivery, price—330 times over.

Send for bulletins detailing our experience and facilities. Our plant is equipped for welding 2-inch thick material—and for lifting 80 tons.

Downingtown Iron Works, Inc.

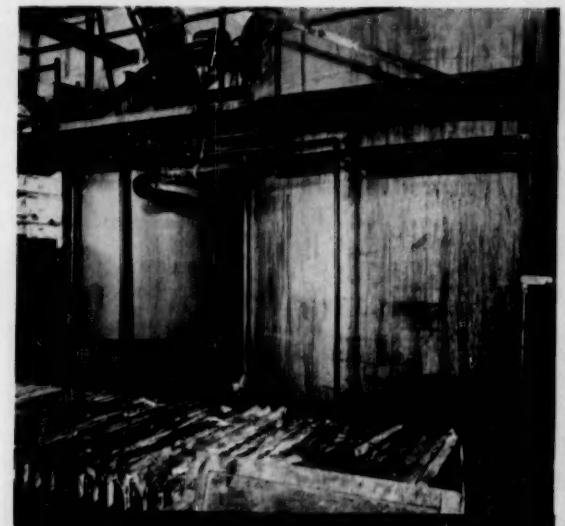
140 Wallace Ave., Downingtown, Pennsylvania

division of PRESSED STEEL TANK COMPANY Milwaukee

Branch offices in principal cities

HEAT EXCHANGERS—STEEL AND ALLOY PLATE FABRICATION

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS





GOODYEAR INDUSTRIAL PRODUCTS

G.T.M.-Specified Typical Uses for

PLIOWELD (corrosion-resistant rubber lining or covering)

- Tanks—rectangular, round, square, open top, flat or dished heads
- Tank Covers—flat, box, radius types
- Truck Tanks
- Tank Barges
- Railroad Tank Cars
- Fans—blades, wheels, housings
- Flanged Pipe and Fittings
- Fume Hoods and Ducts
- Scrubbers and Towers
- Air Purifiers
- Agitators
- Troughs and Chutes
- Continuous Vacuum Filters
- Pumps
- Filter Frames
- Miscellaneous Fabricated Items

PLIOWELD can also be used to combat abrasion

Shrugs off acid-alkali attacks—heat and abrasion, too!

It was evident that they needed something very special in rubber-lined tanks when they decided on new mixers at this Kentucky paint-pigment color plant. The highly corrosive solutions called for sulphuric acid—up to 93%; hydrochloric acid up to 28%. Alkaline conditions frequently reached a pH of 11.5. The temperature was above the boiling point—often for 2 hours at a stretch. And the abrasion was from the murderously sharp edges of crushed ice used for cooling.

All this made for a king-size problem—until they decided to turn the whole thing over to the G.T.M.—Goodyear Technical Man. He arranged to handle all the details. The tanks were built to the customer's specs. The G.T.M. had them lined with PLIOWELD, especially compounded corrosion- and abrasion-resistant rubber—and installations were made right on schedule.

Today, the G.T.M.'s tanks have two years of satisfactory, trouble-free service to their credit—look good for years more. And the G.T.M. is credited with another "turn-key" job—handling everything from blueprints to installations—all to the customer's complete satisfaction.

What about rubber lining problems in your plant? The G.T.M. will be glad to take over for you—getting the complete job done just the way you want it. You can reach him—right now—through your Goodyear Distributor or by writing Goodyear, Industrial Products Division, Akron 16, Ohio.

PLIOWELD TANK LININGS by

GOODYEAR

THE GREATEST NAME IN RUBBER

Pliowald—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio



Photo courtesy of General Dynamics Corp.

When the *Skate*, U. S. Navy's newest atomic submarine, slid down the ways, she was equipped with Fulflo Filters.

When you need dependable micronic filtration, you, too, can rely on Fulflo Filters. They are engineered to your exact requirements — for all types of industrial fluids: oils; liquid chemicals; water; liquid fuels; lacquers, paints, thinners; compressed air, CO_2 and other gases. Standard models meet all normal operating conditions. Special filters can be engineered for full-flow filtration up to 2000 gpm or pressures as high as 5000 psi, at minimum pressure drop. Wide variety of filter elements and containers is available.

Call on Commercial for dependable micronic filtration. For technical literature or engineering assistance, address Department MM.

Micro-Fine Filtration for Low Cost Clarity



COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
PURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

How LINK-BELT'S complete screw conveyor service

saves you time
spares you details

Here's a single, all-inclusive source for standard or special requirements

This four-point program provides quick and easy answers to any screw conveyor problem. Link-Belt offers you the widest range of component types and sizes. For example, you choose from 17 basic screw designs—in any suitable metal to meet temperature, corrosion, sanitation, abrasion and other requirements . . . in a full range of diameters, gauges and pitches. Whatever you need in components . . . and to whatever extent you require engineering counsel — Link-Belt will devise a system "tailored" to your specific needs. Ask your nearby Link-Belt office or authorized stock-carrying distributor for 92-page Data Book 2289.

ANALYSIS AND ENGINEERING service is provided by a district sales office in your area. Link-Belt district engineers can quickly ascertain the best conveying arrangement for your specific application.

COMPLETE LINE OF SCREW CONVEYOR COMPONENTS and related elevating, conveying and power transmission equipment is your assurance that specific needs will be fulfilled most efficiently and economically.

EASY ERECTION is achieved because of prefitting, match marking, close-tolerance manufacturing and layout drawings. Link-Belt will handle entire erection assignment if you wish.

SATISFACTORY PERFORMANCE is assured when you rely on Link-Belt as a single-contract source for your complete system. We will accept full responsibility for placing it in operating readiness for you.

◀ **SCREW CONVEYORS** are readily adaptable to inclined (left), horizontal or vertical handling of bulk materials.

LINK-BELT

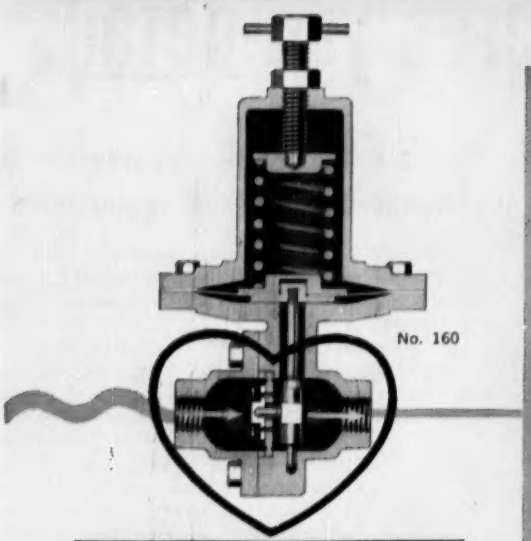
SCREW CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 14,388

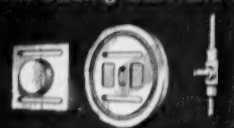
COMPLETE LINE OF COMPONENTS INCLUDES:



OPW-JORDAN
pressure reducing
VALVE



with the Sliding Gate and Plate



the heart of the OPW-JORDAN Valve

THE DIFFERENT AND IMPROVED WAY TO CONTROL PRESSURE.

- DEAD END SHUT-OFF
- WIRE DRAWING MINIMIZED OR ELIMINATED
- SELF-LAPPING SEAT
- NO HUNTING . . . SHORT STROKE FOR IMMEDIATE RESPONSE

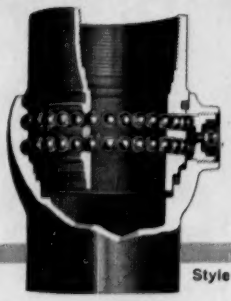
The unique Sliding Gate seating design and exclusive features of this valve are responsible for its outstanding performance and long dependable service life. Metallic diaphragm, metal to metal seals, no packing or gaskets to deteriorate, straight-thru body and durable construction assure precise regulation with immediate response and unusual sensitivity under hard, constant use.

Daily replacing troublesome pilot operated valves.

For interesting facts, write for Bulletin J-160.

swing your products into line

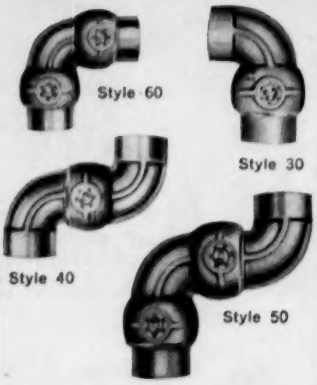
SWING EASY!



FLOW EASY!

Style 20

OPW
SWING JOINTS



FULL UNRESTRICTED FLOW • EFFORTLESS MOVEMENT • GREATER LOAD CARRYING CAPACITY • "O" RING SEALED CONTAMINATION FREE OPERATION • PERFECT ALIGNMENT

The wide range of sizes and styles of OPW BALL BEARING SWING JOINTS offers many and varied applications for safely handling liquids of diversified viscosity at required temperatures and working pressures.

Free Catalog F-8 provides engineering data, sizes, styles and recommendations.

BRONZE • STEEL • ALUMINUM • MONEL

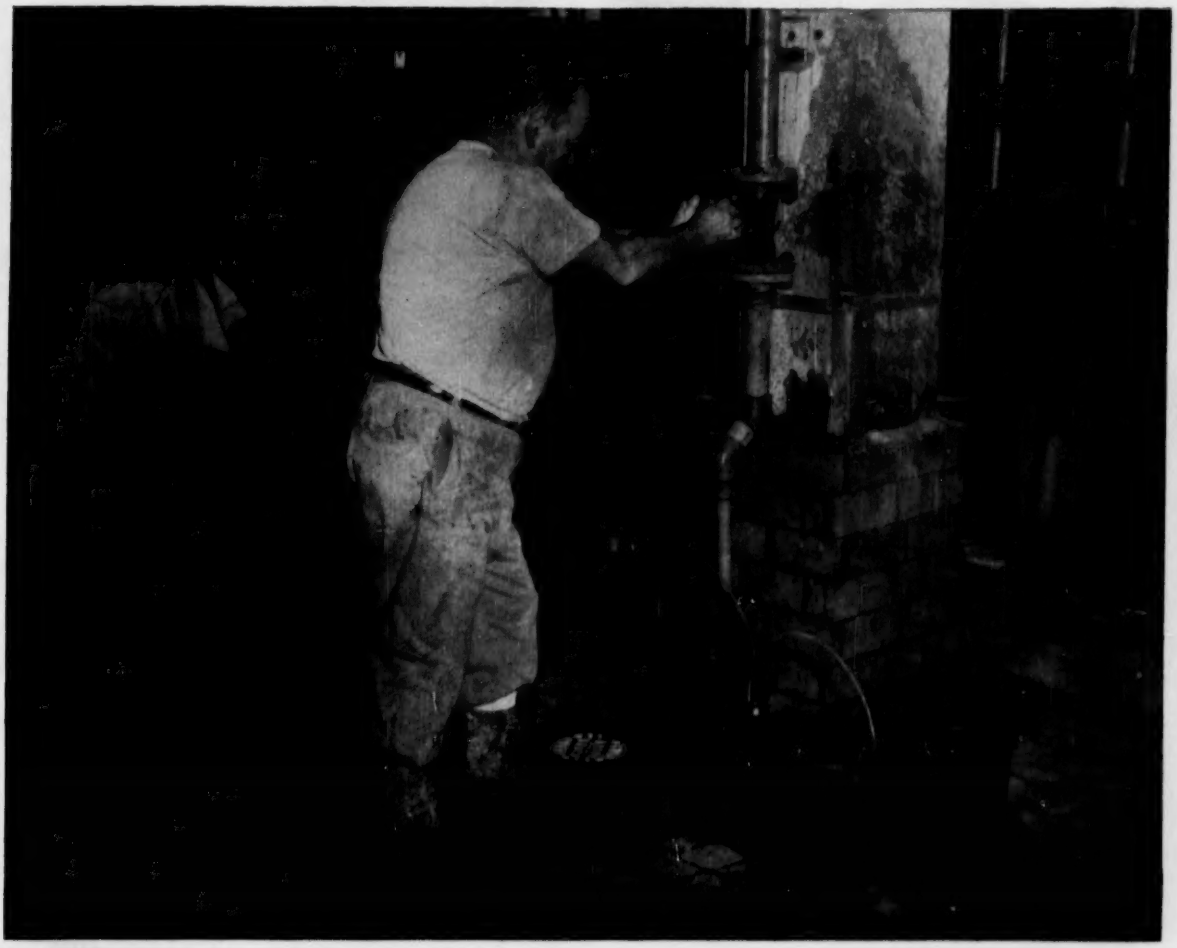
OPW CORPORATION — FOR HANDLING HAZARDOUS LIQUIDS — OPW — VALVES · FITTINGS · ASSEMBLIES — CINCINNATI 1, OHIO

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B.F.Goodrich



Skins become leather faster—because of Koroseal

PROCESSING of leather at the Allied Kid Company of Wilmington, Delaware requires a good deal of muriatic acid . . . and it's carried through B.F.Goodrich rigid Koroseal polyvinyl chloride pipe.

When other types of flexible and rigid piping were used, deposits built up within the bore and cut down acid flow. Weight, high cost, susceptibility to cuts and abrasions were other disadvantages.

Acting on the recommendation of chemical suppliers, Allied Kid installed Koroseal PVC pipe and find it has all the properties they seek.

Rigid Koroseal resists abrasions, has high impact resistance, is impervious to muriatic and other acids as well as alkalies, salts and oils. Koroseal is light and easy to handle, cuts installation and maintenance costs. Koroseal's mirror smooth bore does not permit build-up of deposits within the pipe.

If you need pipe in your plant, whatever the purpose, be sure to investigate Koroseal PVC. Koroseal installations have contributed to greater efficiency and more profitable operations in countless industries. Koroseal PVC also is available in sheet and rod form.

For more information send in the coupon on your right. *B.F.Goodrich Industrial Products Company, Marietta, Ohio.*

B.F.Goodrich

INDUSTRIAL PRODUCTS

B.F.Goodrich Industrial Products Co.
Dept. CE-9
Marietta, Ohio

Please send me free booklets on:

☐ Rigid Koroseal Pipe
☐ Rigid Koroseal Sheet

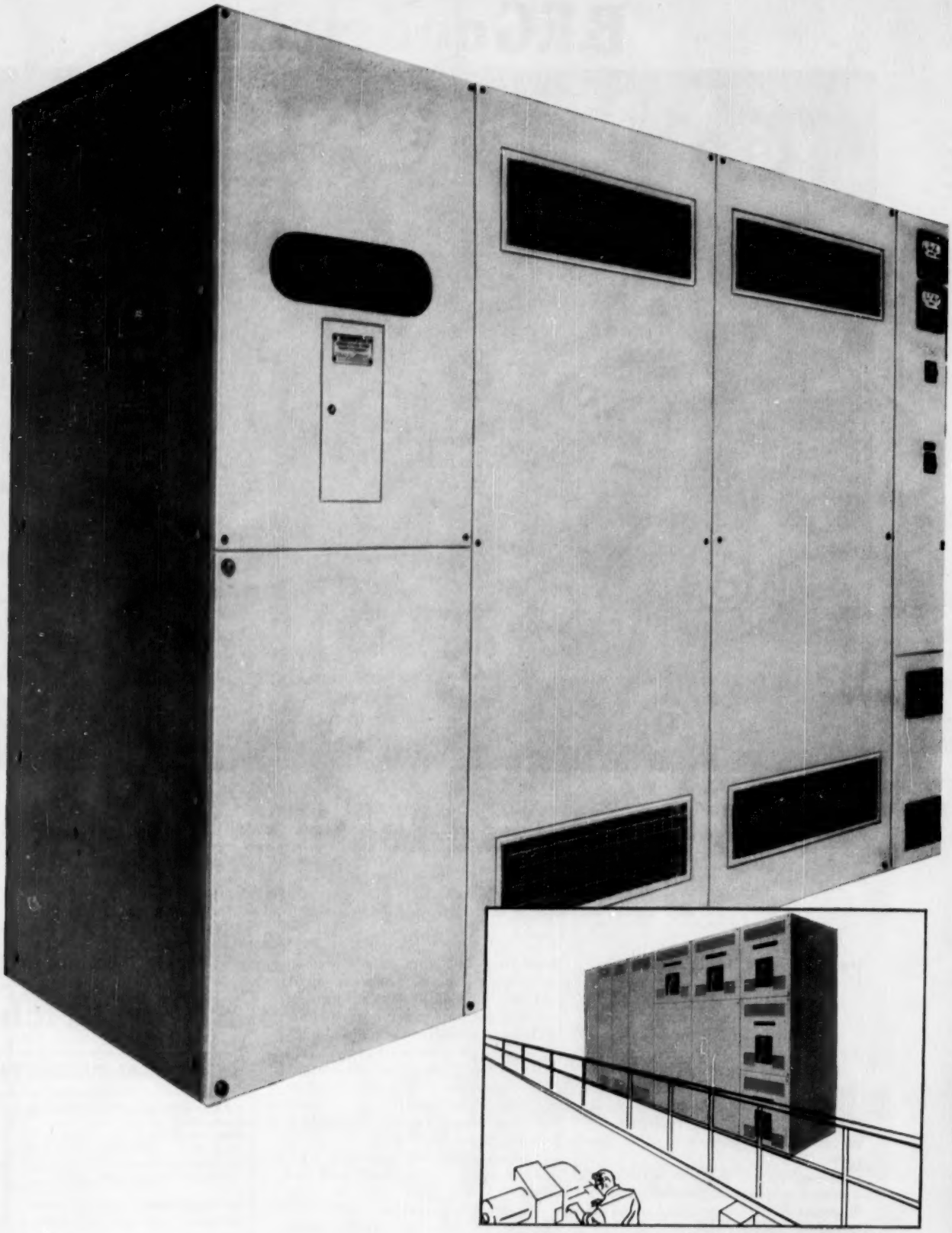
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Company_____

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Koroseal—T. M. Reg. U. S. Pat. Off.

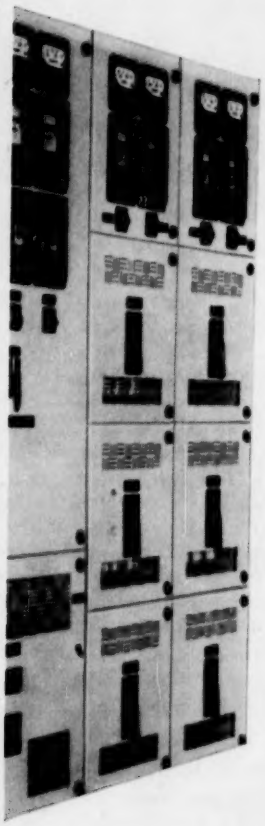


BALCONY or mezzanine installations save floor space, put power closer to load.

Long bus runs are expensive

for utilization voltage

YOU'LL SAVE WITH POWER CENTER CLOSE TO LOAD



The cost of distributing power at utilization voltage in your plant can—and does—run into fancy red ink figures. Line losses multiply. Voltage drops. Motors run hot—heaters run cool—lighting efficiency fades.

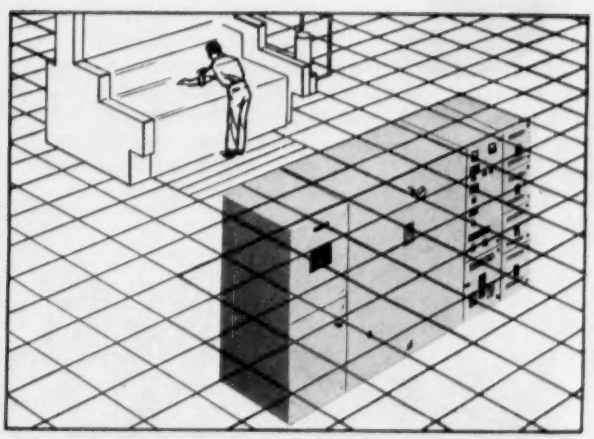
Westinghouse power centers can stop these losses and, depending on the size of your operation, the savings can pay for the initial investment suprisingly fast.

Westinghouse dry-type power centers are lighter. You can put them in the basement, put them on mezzanines—get closer to load, save space. They're packaged—transformer, breakers and associated equipment all factory assembled to specification—ready to set down and connect. They're simple to maintain—no liquids to reclaim, drain and replace. They're fire-safe—safer for personnel—more reliable for continuity and protection.

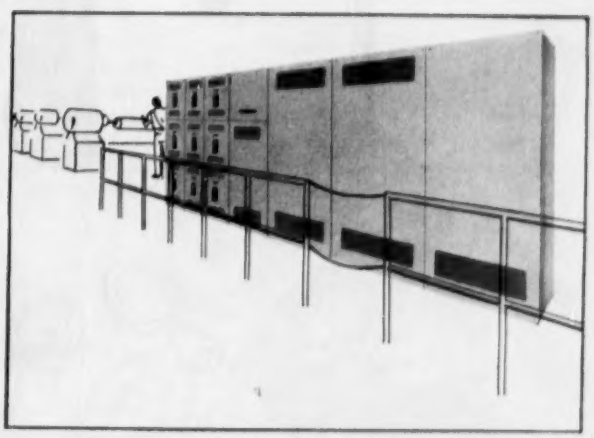
You can't afford not to expand or modernize your plant power distribution with power centers. Get the whole story from your Westinghouse sales representative—or your electrical contractor. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania, requesting *new* D. B. 34-150.

J-60902-A

YOU CAN BE SURE...IF IT'S Westinghouse



BASEMENT or underground vault may utilize either ventilated or sealed dry-type power center.

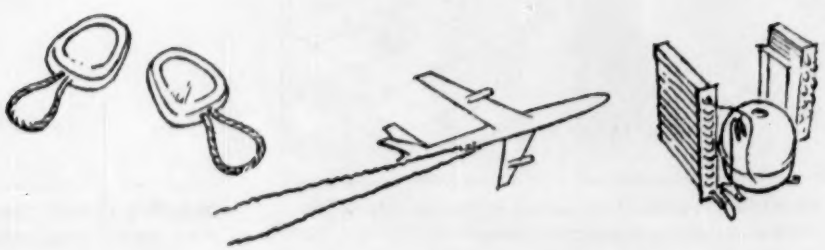


DRY-TYPE POWER CENTERS take a minimum of space when placed in the middle of production areas.

Report No. 3 of a series

I was a slave to weather until I found





Kathabar® systems maintain spaces at 80 F and 55% RH, or lower, for processing, storage, and testing!



You can pick the best production weather you've ever had, and reproduce it every day of the year. You can set the exact storage temperatures and humidities which are ideal for your product. And in your testing lab, you can imitate any climate on earth.

All of this you can do economically with a Kathabar-engineered air conditioning system. In many applications, cooling can be accomplished with available water (e.g., a Kathabar system can reduce 72 F dew point air to 46 F dew point with 85 F cooling tower water). Refrigeration, when needed, is free to handle only sensible cooling with minimum tonnage and higher suction temperatures—without frost or duplicate coils. No overcooling or reheating necessary.

let's look at cases

This sampling of Kathabar installations will show you how effective and versatile a Kathabar system can be.

9 climates for candy

Candy's sold seasonally, but manufacturing economy demands uniform production throughout the year. A Chicago company uses Kathabar systems to store different types of candy in 9 separate zones. Humidities range from 12 to 50% RH; temperatures, 50 to 85 F.

zoned for profits

Another candy manufacturer spots individual Kathabar units and cooling units to fit the varied requirements of drying, chilling, polishing, coating, bottoming, packaging, storage, and comfort. One example of Kathabar-earned profits: polishing time cut in half.

ethical competition

In the high-volume, low-margin pharmaceutical industry, companies always seek new ways to reduce costs and improve quality control. One of the biggest companies achieves both with Kathabar systems in over 100 air conditioning zones. Outside weather can not interrupt processes. As a bonus, Kathabar systems deliver sterile air.

getting jets off the ground

The chemicals in solid rocket fuels are extremely hygroscopic, and must be dried before use. Kathabar systems protect their physical properties and insure accurate ballistic results. Process areas are maintained at precise conditions, even when hosed down frequently.

relieving printers' headaches

Kathabar systems keep printing papers from getting too wet or too dry; improve ink distribution and drying; eliminate the variables in plate-making. Printers earn new profits with more press time, fewer schedule upsets.

fast compressor assembly

Water vapor in a refrigerator compressor could cause obvious troubles. A Kathabar system enabled a large manufacturer to switch from batch to continuous drying—and cut production time, handling, and manpower.

who uses Kathabar systems

Kathabar systems make profits out of air for these industries:

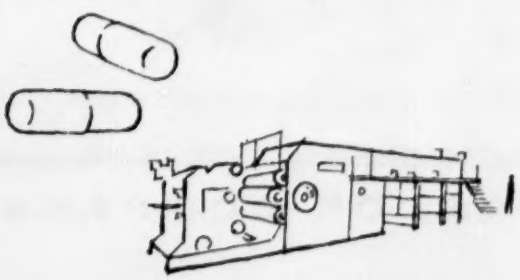
Atomic Energy	Machining
Breweries	Matches
Cake Mix	Marine
Candy	Meat
Cellophane	Offices
Cellulose	Ordnance
Cereals	Paper
Chemicals	Pharmaceuticals
Coffee	Plastics
Comfort	Printing
Compressors	Rockets
Cookies	Rubber
Electronics	Shellac
Explosives	Sugar
Film	Sanitaryware
Foundries	Testing
Gelatin	Textiles
Glass	Transformers
Glue	Transistors
Gum	Vacuum Tubes
Hospitals	Varnish
Hotels	Waterworks
Lacquer	Wire
Lenses	Yeast

how they use Kathabar systems

Many of these industries use Kathabar systems to maintain spaces at 80 F and 55% RH or lower. Others use them to (1) obtain continuous air at sub-freezing dry bulb and dew points; (2) eliminate condensation; (3) deliver sterile air at specified dry bulb and dew point; and (4) improve drying processes.

send description of your problem

Air Conditioning and Drying Division
SURFACE COMBUSTION CORPORATION
2380 Dorr Street Toledo, Ohio



Kathabar systems by Surface

Introducing FISHER ELECTRO-





TYPE 340

SEE THIS EQUIPMENT AT CLEVELAND ISA EXHIBIT BOOTHS 914-916-1003

Recent trends toward electrical control loops have created a need for final control elements capable of utilizing their greater sensitivity and speed. Fisher Electro-Hydraulic Operators are self-contained, electrically operated valve actuators, ideal for use in such control loops. They produce high performance without the use of electronic amplification, utilizing only a simple DC electrical circuit to control the hydraulic pilot. The pilot systems incorporate no close fitting parts, but use simple nozzle-flapper combinations to control hydraulic pressure.

Two sizes are available. To handle the most demanding control jobs Type 350 has a maximum stem thrust of 2000 pounds and is available for use on valve sizes ½" to 16" with strokes from ½" to 3". Type 340 is designed for the average control job. It has a maximum stem thrust of 600 pounds and is available for use on valve sizes ½" to 4" with strokes from 7/16" to 1½".



Rugged, simple design plus accurate, dependable performance, make the FISHER Electro-Hydraulic Operators the outstanding electric final control elements available.

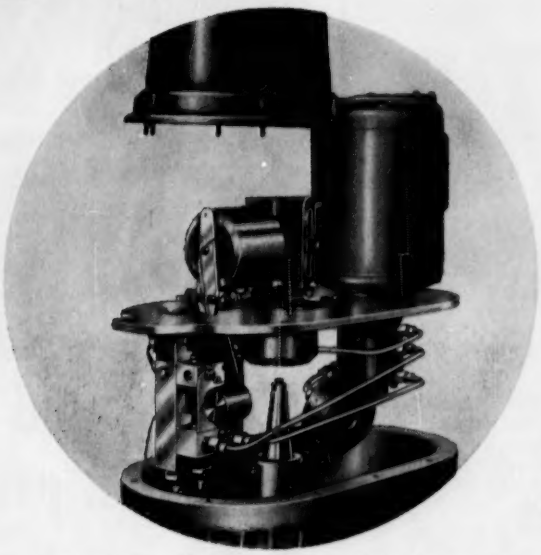
WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND

FISHER GOVERNOR COMPANY

HYDRAULIC OPERATORS



TYPE 350



TYPE 340

- Adaptable to all DC output signals
- Requires only zero and travel adjustment (both readily accessible)
- Stroking range from 7/16" to 1½"
- Stroking speed 0.1"/sec.
- Resolution sensitivity—0.2% of input range
- Maximum stem thrust 600 pounds
- Operates on simple DC—no electronic amplification
- Valve sizes from ½" to 4"

TYPE 350

- Adaptable to all DC output signals
- Requires only zero and travel adjustment (both readily accessible)
- Stroking range from ½" to 3"
- Stroking speed 0.37"/sec.
- Resolution sensitivity—Better than 0.05% of input range
- Maximum stem thrust 2000 pounds
- Operates on simple DC—no electronic amplification

Valve sizes from ½" to 16"

LIQUID LEVEL CONTROL

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Other Fluoroflex-T® Products



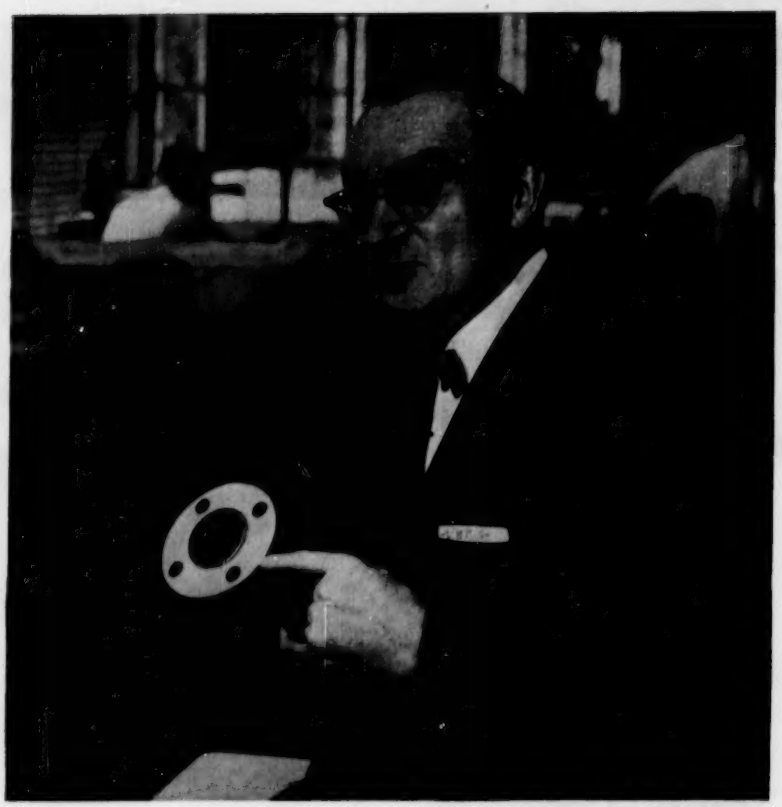
Chemical-proof flexible joint for severest service

MOLDED Fluoroflex-T reinforced bellows — a Resistoflex development — become strong links in any system where you need corrosion-proof flexible or expansion joints. Unlike bellows machined from solid stock, molded units have better grain structure, hence, superior flex life.

In one test by a user, Fluoroflex-T bellows were eccentrically flexed for twenty million cycles without fatigue or failure. These units have since been thoroughly time-proved in actual service.

Fluoroflex-T bellows dampen vibration, absorb expansion, correct misalignments... problems especially acute in fragile piping systems. Units can be fabricated for specific installation or operational requirements. Send for details.

CAUTION: Because the properties of Teflon products can be varied widely by the fabricating methods employed, the fabricator's experience and integrity remain the user's best assurance of quality and performance.



A new "end" for corrosion problems in hose

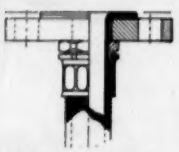
See how the patented Fluoroflex®-T tube is carried through the fittings and formed over the flange face. Here is complete protection against corrosion because fluids cannot possibly come in contact with metal.

This is the first time chemically inert jacketed fittings have been combined with chemically inert hose in a *continuous* integral assembly.

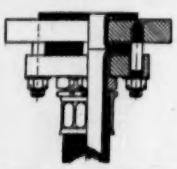
Fluoroflex-T flanged hose assemblies eliminate the need for special consideration of the type of metal used in the fittings — either for anti-corrosion or contamination needs. As a result of the continuous smooth bore construction, cleaning problems and entrapment of materials are eliminated for all practical purposes.

This hose handles active chemicals, solvents, gases and the most corrosive compounds. It is also applicable where vibration is a problem. It is non-aging . . . lasts indefinitely even at 500°F.

Write for data.



See how Fluoroflex-T tube is carried through fitting and across face of flange.



For frequent disconnects, a modified construction is available using a secondary Fluoroflex-T jacketed flange. This is replaceable, spares the major assembly from seal-damage.

® Fluoroflex-T is a Resistoflex trademark, reg., U.S. off.
® Teflon is a DuPont trademark.

Originators of high temperature fluorocarbon hose assemblies

Resistoflex
CORPORATION
Roseland, New Jersey · Western Plant: Burbank, Calif. · Southwestern Plant: Dallas, Tex.

KELLEY

SERVING THE NUCLEAR INDUSTRIES

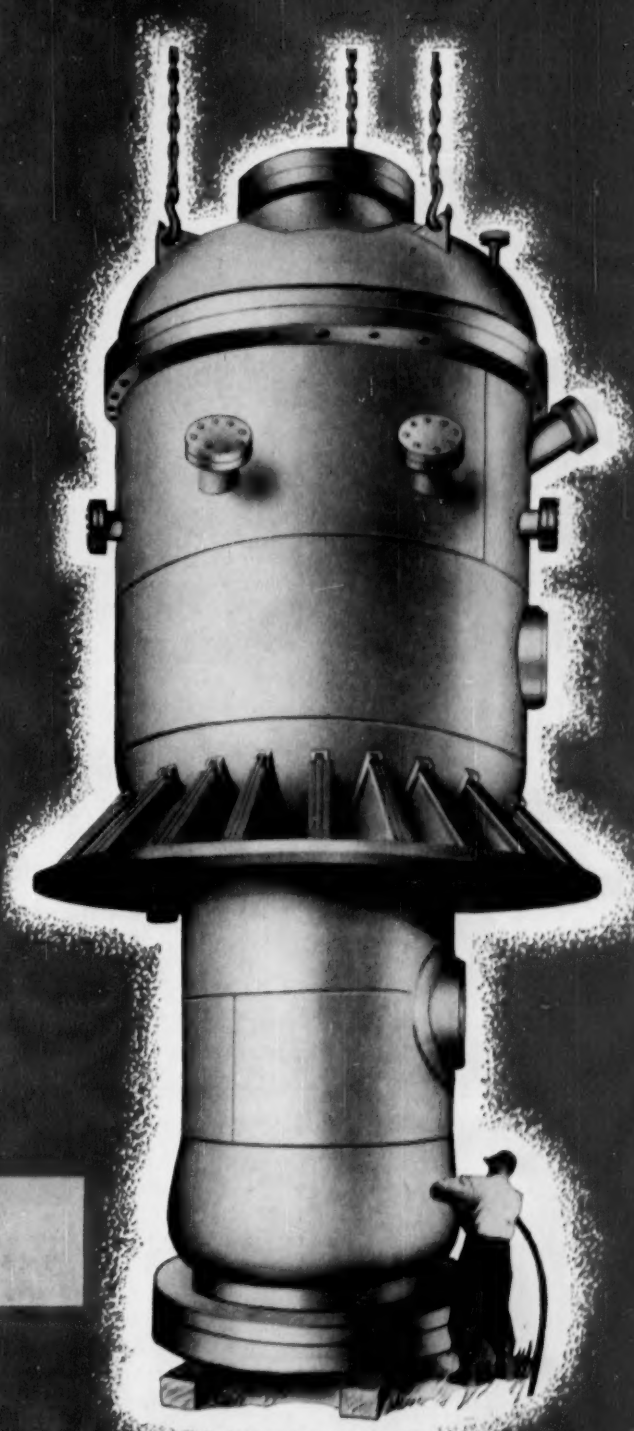
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Stainless steel equipment of intricate design, fabricated to precise tolerances. Years of experience in the A. E. C. field enables us to meet your most rigid requirements...



.... **ETR** recently built by O. G. Kelley & Company for the A. E. C. installation, Scoville, Idaho.

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CYANAMID—and

Life on the Chemical Newsfront

The modification of natural polymers and the creation of new ones—these are the areas in which Cyanamid is active in "big molecule" chemistry.

Of the Cyanamid divisions that participate in polymer chemistry, none is centered so completely upon the practical developments of long-chain and cross-linked molecules as the Plastics and Resins Division. Polymers and polymer systems are offered for applications ranging from flexible surface coatings to extra-hard molded and cast plastics. Cyanamid's extensive research and development in plastics technology has resulted in the following well-known product lines:

MOLECULE MAINTENANCE
"Giant" long-chain and cross-linked molecules are often subject to gradual deterioration through the action of atmospheric oxygen and ultraviolet light. Cyanamid has developed antioxidants and ultraviolet absorbers which combat these destructive influences and greatly prolong the useful life of plastics and elastomers.



RUBBER BRAVES THE WEATHER—yet retains its appearance, strength and flexibility through years of use thanks to highly effective antioxidants. Cyanamid Antioxidant 2246® and Antioxidant 425® not only satisfy oxidation-protection requirements of all types of natural and synthetic rubbers, but are also nondiscoloring and can be used with the whitest of rubbers.
(Organic Chemicals Division)



AN INVISIBLE SHIELD against invisible destruction—that's the role of Cyanamid's ultraviolet absorbers as they convert ultraviolet rays to harmless heat. As a result, polymers, such as this plastic hose, retain their color, strength and flexibility for greatly increased periods even through severe exposure conditions. Cyanamid's UV 9* Ultraviolet Absorber, for example, has greatly expanded the application possibilities of polyvinyl chloride, polyester resins, styrene polymers and other plastics. **(New Product Development, Dept B)** ***Trademark**

the world of "Big Molecules"

BEETLE® Urea Molding Compounds
LAMINAC® Polyester Resins
REZYL® Alkyd Resins
CYCOPOL® Copolymer Coating Resins
CYZAC® Coating Resins
MELURAC® Melamine-Urea Adhesives
URAC® Urea Adhesives
CYMEL® Melamine Molding Compounds and Laminating Resins
CYMAC® Methylstyrene Molding Compounds

(Plastics and Resins Division)





BUILDING BLOCK AND MODIFIER for giant molecules is Cyanamid's Acrylonitrile. As a building block, it yields diverse products such as the synthetic fibers used in luxurious sweaters and blankets. As a modifier, it reacts with natural polymers such as proteins, starches and cellulose, improving their physical and chemical properties, thereby greatly widening their range of applications. Many derivatives of Acrylonitrile serve as monomers in practical applications — Acrylamide, for example, used in water-sensitive polymers.

(Organic Chemicals Division)



AN INCREASINGLY POPULAR POLYMERIZATION TECHNIQUE to build large molecules is the emulsification of monomers in aqueous solution, permitting rapid, controlled polymerization at moderate temperatures. Cyanamid's **AEROSOL®** Surface Active Agents are ideal in this application, providing excellent monomer solubilization, emulsion stability and resistance of dried polymer films to water spotting.

(Industrial Chemicals Division, Dept B)

CYANAMID

AMERICAN CYANAMID COMPANY
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

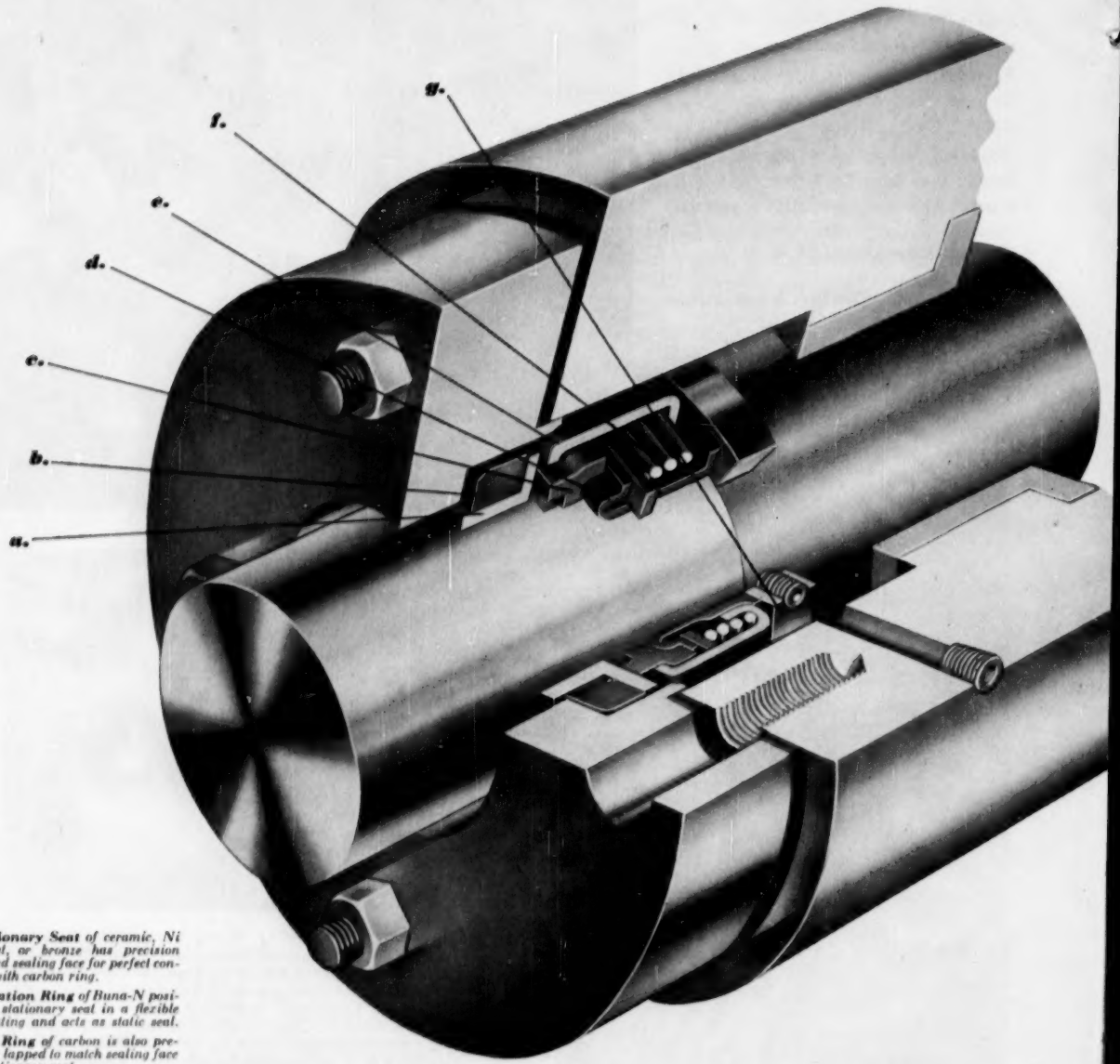
Helping America Make Better Use of Its Resources

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For further information on these and other chemicals, call, write or wire American Cyanamid Company

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No More Stuffing Box Maintenance!



a. Stationary Seat *of ceramic, Ni Resist, or bronze has precision lapped sealing face for perfect contact with carbon ring.*

b. Vibration Ring *of Buna-N positions stationary seat in a flexible mounting and acts as static seal.*

c. Seal Ring *of carbon is also precisely lapped to match sealing face of stationary seal.*

d. Roll type Bellows *permits free movement of seal ring.*

e. Shell, *encases entire rotary unit and furnishes mechanical drive for seal ring.*

f. Stainless Steel Spring *with load precisely calculated to face area of seal.*

g. Stop Collar, *or shoulder, positions seal to specified operating length.*

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GARLOCK

Install Garlock Package Seals on Your Chemical Process Pumps

- ***ELIMINATE LEAKAGE AND SHAFT WEAR***
- ***REDUCE DOWNTIME***
- ***CUT MAINTENANCE COSTS***



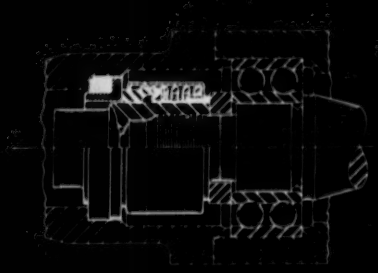
When leakage and maintenance are serious problems in the operation of your pumps you'll find a perfect answer in Garlock MECHANIPAK* Seals. Installation on new or existing equipment is simple. And, several designs are available to meet a variety of operating conditions: pressures to 150 psi, temperatures to 212° F., and shaft speeds to 2000 feet per minute. Sizes for shafts from ⅜" to 3" diameter for sealing against water, oils, alcohol, mild acids and solvents.

MECHANIPAK Seals are another important part of "the Garlock 2,000" . . . two thousand different styles of packings, gaskets and seals for every need. It's the only complete line . . . that's why you get unbiased recommendations from your Garlock representative. Ask him for complete data on this long-life, maintenance-free MECHANIPAK Seal. Or write for Folder AD-150.

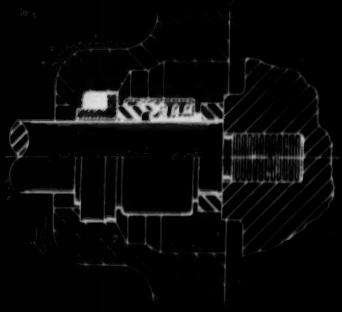
*Registered Trade Mark



Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products



MECHANIPAK Package Seal installed on shaft for retaining lubricant in bearing.



MECHANIPAK Package Seal installed against impeller of centrifugal pump.



Package Seal installed on vertical pump shaft.



Double Package Seal installation on horizontal agitator shaft.



NOW! THE COUPLING WITH THE 4-WAY FLEX!

Para•flex

FLEXIBLE CUSHION COUPLING

THE NEW IDEA IN FLEXIBLE COUPLINGS... WITH A FLEXING BODY THAT AUTOMATICALLY COMPENSATES FOR ALL COMBINATIONS OF MISALIGNMENT AND END FLOAT... AND CUSHIONS SHOCK LOADS!



THIS Coupling "swallows up" misalignment! Its ability to handle multiple displacement is exceeded only in a universal joint. It outperforms the most complex coupling mechanisms—yet it operates with the simplicity—*and the dependability*—of a modern tire!

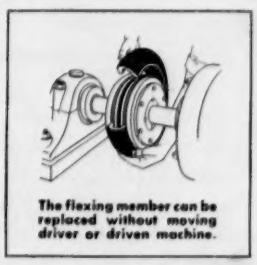
The technological advances that contribute to the miracle of today's truck tires, which are engineered to carry tremendous loads at high speeds and stand terrific shock, have made this new type of coupling possible.

The heart of Para-flex is a tire with synthetic tension members bonded together in rubber. It is pliant. It "fits itself" to changing shaft conditions—angular, parallel, end-float, *or any combination of all three!* Depending upon the size of coupling and duration of shaft misplacement, it handles angular misalignment up to 4°, parallel up to ⅛" and end-float up to 5/16".

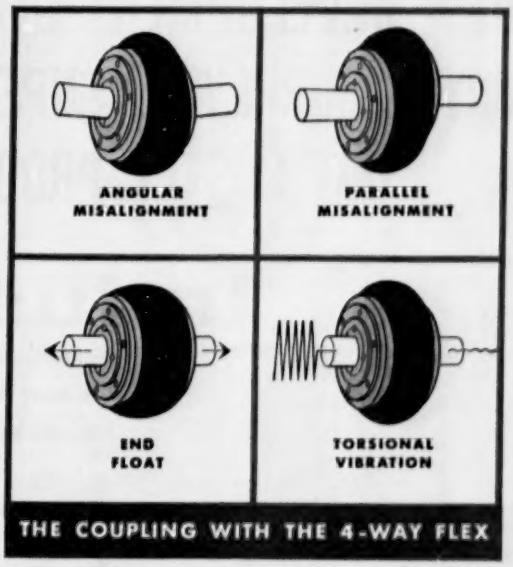
It cushions the stresses of shock loads to a remarkable degree. And it tends to absorb torsional vibration—reducing noise and protecting machinery from vibration's destructive forces.

There is no metal-to-metal contact between shafts. They are insulated. No lubrication is required.

Para-flex takes a minimum of space on the shaft. Mounting is simplified through the use of standard Taper-Lock bushings—no reboring, no machining. Safety is promoted by flush design; there are no protruding parts. And since the flexible member is molded with a transverse split, it can be replaced *without moving either the driver or driven machine!*



The flexing member can be replaced without moving driver or driven machine.



Para-flex Couplings are stocked by Dodge Distributors in popular transmission sizes. They are available from factory stock in capacities up to 600 hp at 900 rpm. Call your distributor for early delivery to *make your own test.* You'll witness something revolutionary!

DODGE MANUFACTURING CORPORATION, 200 Union Street, Mishawaka, Indiana

DODGE

of Mishawaka, Ind.



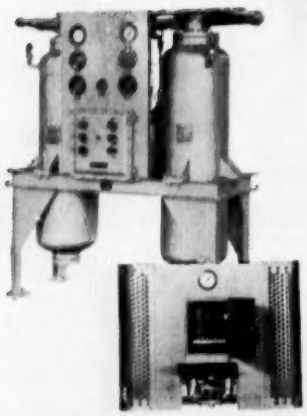
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AT LAST!

A Dryer Reactivated Without Heat!

NEW DEVELOPMENT OFFERS A DESICCANT TYPE DRYER SUPPLYING SUPER-DRY AIR OR GAS WITHOUT COSTLY, PROBLEM-MAKING HEAT!

Industrol a leader in the field of dynamic dehumidification for over 10 years, introduces the new INDUSTROL HEAT-LES DRYER* with the following advantages:



- 18 models available with chamber sizes from 2″ to 30″ in diameter which handle flows from 2 to over 1800 standard cubic feet a minute.
- The unit will provide effluent dewpoints of −100° F. to −140° F. continuously, regardless of even major fluctuations in the temperature of the gas or air.
- Installation costs reduced.
- Maintenance costs reduced.
- Effluent air or gas temperatures remain constant.
- Steam or electric heaters are not required, eliminating KW and steam consumption.
- Virtually all corrosion problems are eliminated, as the rejected water is handled as a vapor rather than as a liquid.
- Explosion proofing costs may be eliminated completely by pneumatically operated control.
- Outdoor installation is simplified as insulation is no longer required.

Write today

for free information and specifications or contact your local Trinity Representative.

INDUSTROL DRYERS ARE MANUFACTURED BY

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U.S.I. CHEMICAL NEWS

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★

Chemical Polish for Pure Zinc Improved With Ethyl Alcohol

An improved polish for zinc, consisting of nitric acid, ethyl alcohol, and hydrogen peroxide has been developed by a leading research laboratory.

Immersion of pure zinc for about two minutes in a bath of these chemicals is said to produce a high and lasting luster that resists rapid oxidation up to temperatures of around 660°F in air or in a sodium-potassium nitrate salt bath.

The role of ethyl alcohol in this polish appears to be that of a moderator of the nitric acid. Although polishes composed of other chemicals have been used for zinc, the nitric acid-ethyl alcohol-hydrogen peroxide polish is said to have longer life and to produce on the zinc a thinner oxide film of increased stability.

It is recommended that users prepare the polish fresh daily. *Caution:* ethyl alcohol should never be poured into nitric acid; the reverse, however, may be done safely. Interested readers who wish detailed assistance may call on U.S.I.'s technical service staff.

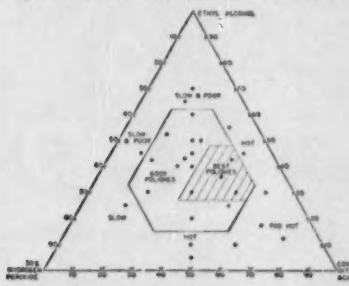


Diagram illustrates chemical polishing baths for zinc, based on 2 min. immersion time. (Diagram from "Journal of Metals.")

New Centrifuges Underscore Titanium Strength

High speed centrifuges fabricated with an aluminum-vanadium alloy of titanium now are in operation on an experimental basis. They are reputed to run 28% faster than stainless, with no greater working stress in the bowls.

Steady increase in such applications of titanium is expected—namely, where high strength-weight ratio as well as corrosion resistance is needed. Titanium now can be alloyed, welded, and bonded with chrome (U.S.I. Chemical News, May, '57). With three times the strength of aluminum, but only half the density of steel, titanium has been in heavy demand for aircraft components subject to severe resonance conditions.

U.S.I. is building a titanium sponge plant at Ashtabula, Ohio, which is expected to go on stream late this year. This modern plant will employ a sodium reduction process, and on the basis of present figures will turn out high purity titanium sponge at lower cost than any other existing commercial technique.

Organosodium Compounds Open Way to Economical Synthesis of Many Organometallic Compounds

Higher Yields Than with Conventional Grignard Reagents; Safer, Simpler Processing Among Advantages Cited

Many organometallic compounds can now be synthesized economically and safely from organosodium compounds, according to a paper recently presented before the American Chemical Society. In some cases the latter compounds can be used as intermediates to prepare an otherwise hard-to-make Grignard reagent. In others they can be reacted directly with metal halides to form new carbon-metal bonds.

Grignard reagents, compounds of magnesium with an organic halide, have long been standard building blocks for synthesizing organometallic compounds. However, from the commercial standpoint many Grignard reagents are difficult and hazardous to prepare, some require costly iodides or bromides as starting materials, and yields of desired organometallic compounds are frequently disappointing.

Among the advantages of organosodium compounds cited by the investigators are high yields and safety and convenience in handling.

For example, phenylsodium reacts with boron trichloride to form triphenylborine in 70% yield. Benzylsodium and phosphorus trichloride produce tribenzylphosphorus in 84% yield. Also, in this whole class of reactions, sodium as a starting material is more economical than the magnesium of typical Grignard reagents. Finally, reactions proceed in a hydrocarbon medium, thus eliminating the hazard of storing and handling large quantities of ether, the solvent used with Grignard reagents.

Reactions of RNa Compounds

The route to organometallic compounds from metallic sodium employs two general reactions. In the first an organic halide is reacted with sodium to produce an organosodium compound:

$$RCl + 2\,Na \rightarrow RNa + NaCl$$

This product is then reacted with a metallic halide to yield the desired organometallic compound:

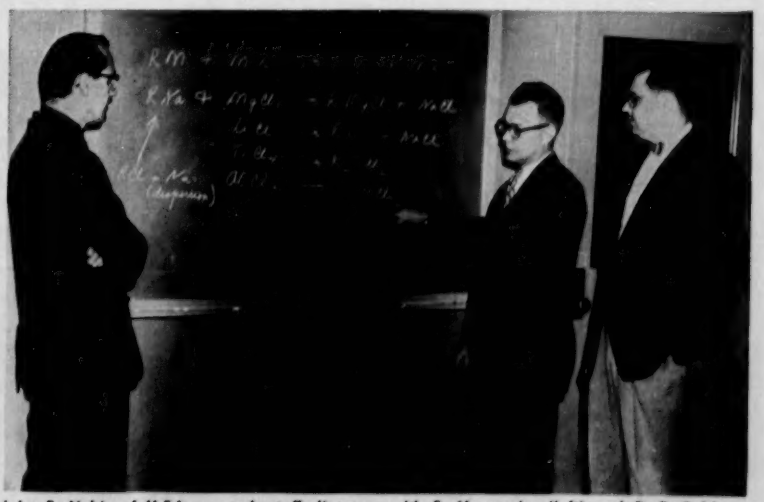
$$RNa + MgCl_2 \rightarrow RMgCl + NaCl$$

Organosodium compounds may react with the halides or alkoxides of lithium, magnesium, mercury, boron, aluminum, silicon, germanium, tin, lead, titanium, zirconium, phosphorus and iron.

Sodium Dispersions Key Factor

The recent introduction of simple and safe techniques for laboratory or plant preparation of finely dispersed sodium has stimulated wide interest in the use of organosodium compounds. Hansley's studies on preparation

MORE



John F. Nobis of U.S.I. research staff discusses with F. Moormeier (left) and R. E. Robinson (extreme right) equations for reaction of organosodium compounds to form various carbon-metal bonds. They presented a paper entitled "Use of Organosodium Compounds for Preparation of Other Carbon-Metal Bonds," at the Spring meeting of the American Chemical Society.

U.S.I. CHEMICAL NEWS

CONTINUED

Organosodium

and use of finely dispersed sodium (10-30 μ) to produce phenylsodium in 90% yields* opened a new era in organosodium chemistry.

Extensive research in U.S.I. laboratories shows that phenylsodium and benzylsodium can be made by carefully controlled conditions which include the presence of a slight excess of freshly dispersed sodium. The reaction between chlorobenzene and sodium under these conditions is immediate and complete: one mole of phenylsodium can be prepared in only 20 minutes. This reaction is easily adapted to larger scale and is now being used industrially.

The largest commercial plant utilizing organosodium compounds will soon be in operation at Tuscola, Illinois where U.S.I. is using disodiooctadiene, made directly from butadiene and dispersed sodium, to produce U.S.I. Isosebacic® acid, a mixture of 10-carbon dibasic acids.

(A new brochure on the preparation of sodium dispersions is available from U.S.I.)

Advantages of Organosodium

Until practical techniques for making sodium dispersions were developed, the reaction of an organosodium compound with magnesium chloride to produce a Grignard reagent had no commercial value. In general, it was easier to prepare Grignard reagents than the corresponding organosodium compounds. Now, however, there are cases where organosodium compounds can be made from starting materials which yield Grignard reagents only with difficulty. For example, organic chlorides react very sluggishly with magnesium, but yield organosodium compounds quite readily.

As a result, many Grignard reagents which have been prepared from expensive iodides or bromides can now be obtained from the cheaper chlorides, often in higher yields than are possible by the former method. Other organosodium compounds, synthesized by reactions which are completely unknown in the field of organomagnesium chemistry, can now be converted to hitherto unattainable Grignard reagents.

*V. L. Hansley, *I&EC* 43, 1759 (1951)

Cube-Shaped Polyethylene Containers for Corrosives Promote Lab Safety

An ingenious new container gives laboratory workers an almost accident-proof way to receive, store and dispense corrosive reagent chemicals.

The package consists of a cube-shaped polyethylene vessel inside a double corrugated paperboard box which serves as a shipping carton. The user need never remove the polyethylene cube from the box; the latter has a slotted opening for a pouring mouth on the cube and a pull-out safety grip for easy handling.

The new container is now being used by a leading manufacturer of reagent chemicals for packaging solutions of sodium hydroxide and potassium hydroxide in 1-gallon size.



It is light, unbreakable, and the unique design makes it convenient to dispense the contents. An economy feature is that no deposits are required, and there are no empties to return.

Polyethylene "Coating", "Lamination" Defined

An industry standard adopted by the National Flexible Packaging Assn. defines the difference between "coating" and "lamination", as these terms are applied to polyethylene packaging.

A coating is "a substance deposited while in a liquid state on a web without the use of adhesive means between the combined materials". Lamination is "the combination of two or more webs by the use of an adhesive layer between the webs".

Coating is the more common method. U.S.I. PETROTHENE 203 is a polyethylene resin that is widely used for this application.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U. S. I.

New adhesives for labels feature resin emulsion glue which penetrates silicone layer to bond on the glass surface. The adhesives feature controlled tacking in clear non-staining micro-thin films which are noncrystallizing, says company. **No. 1260**

A pamphlet on titanium tubing offers information on size range and tolerances and mechanical, physical and working properties of tubular titanium. **No. 1261**

A new remote control baffle for fume hoods is operated from an outside control panel. Manufacturer claims baffle can be quickly adjusted for any desired air flow aperture without interrupting work or exposing personnel to injury. **No. 1262**

A double acting rust remover is said to remove light rust in a few minutes, heavy rust in one to two hours. Deposits a rust-inhibiting film as it works, requires no rinsing of treated metal. **No. 1263**

A new booklet entitled "Zirconium and Hafnium" is now available. It covers in detail the mechanical and physical properties of the materials as well as general methods of fabrication and corrosion resistance. **No. 1264**

A new vinyl paint is said to achieve 5 to 8 times the film thickness per spray pass as other vinyl paints. Supplied in 8 colors, it is also said to be fast drying, easy to apply, economical, corrosion-resistant. **No. 1265**

Deuterated solvents and organo-metallics of high isotopic purity are now available in experimental quantities, with a wide range of research applications, including NMR spectroscopy. **No. 1266**

Color dispersion and intensity in plastics are said to be improved by a new extender. This product is also reported to increase lubricity, mold-release, and brightness of finish in many plastics. **No. 1267**

A continuous water vapor recorder determines low concentrations of water vapor in air or gas streams by measuring heat energy exchanged in adsorption or desorption. Designed for pipe lines, drying towers, feed streams. **No. 1268**

An external manipulator for tubing applies pressure externally on a flexible tube, producing a continuous, metered flow of liquids which can be as low as 0.1 cc. per day, according to the maker. **No. 1269**

A detector kit, small, compact and practical, rapidly determines low concentration of vapors of toluene diisocyanate and toluene diisocyanate urea. Said to be especially useful in plants making polyurethane plastics. **No. 1270**

PRODUCTS OF U.S.I.

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PETROTHENE® Polyethylene Resins.

Esters, Ethers and Ketones: Normal Butyl Acetate, Diethyl Carbonate, Diethyl Oxalate, Ethyl Acetate, Ethyl Ether, Acetone.

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Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

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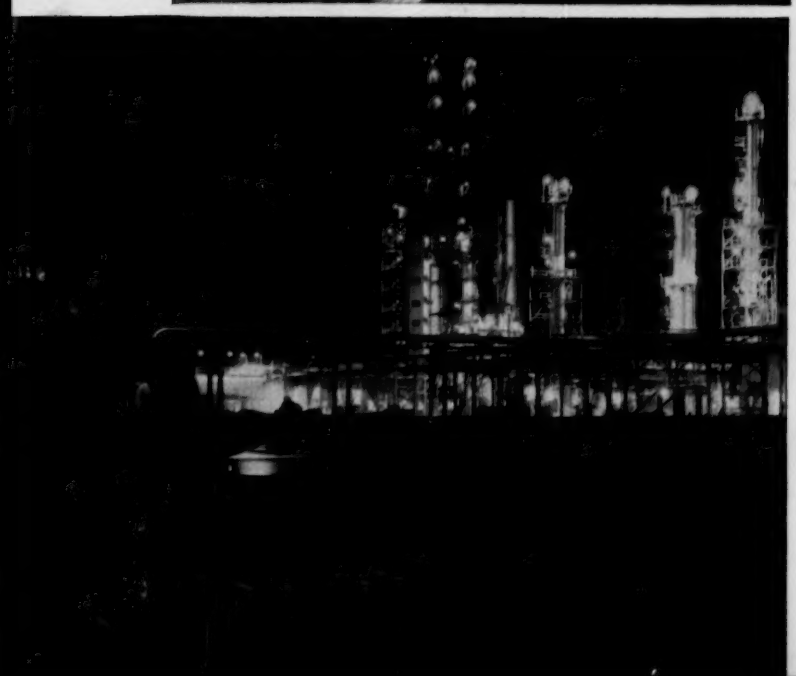
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Take a new look at electrical system dependability



These chemical and petroleum companies did . . . and found new advantages in Westinghouse distribution equipment and engineering counsel.

American Cyanamid and Westinghouse Engineers worked out a power distribution system that prevents outages. If there's trouble on any feeder, power is switched to another. If a substation faults, other substations carry the load through cross connections. This system can be easily and inexpensively expanded as the plant grows.



Sohio's Lima Refinery achieves power dependability without paying extra for stand-by capacity. In a period of over two years, this Westinghouse equipped system handled power interruptions without loss of refinery production.

Get economy with system protection →

YOU CAN BE SURE... IF IT'S

Westinghouse

Call Westinghouse early to . . .

coordinate equipment for low cost, power dependability

Early planning of your power distribution system is the only effective way to answer these basic questions:

1. **How can I get the most reliability for dollars spent?**
2. **Will my electrical system be adaptable to changing load conditions with minimum service interruptions?**
3. **Can I get good voltage regulation in spite of load fluctuations?**

1. Standardized type SL transformers — liquid filled substation transformers for chemical use offer the many economies of Westinghouse standardization and design advantages based on years of tested and proved experience.



The choice of types of equipment and power distribution layout will depend on the problems in your plant . . . change-over, expansion, modernization, new processes or products. Westinghouse can help you select the right equipment and coordinate it to bring out the specific advantages that best suit your requirements.

Here are brief descriptions of the advantages you'll find in Westinghouse apparatus for a proven distribution system. They suggest many ways to provide maximum reliability without the expense of standby facilities.

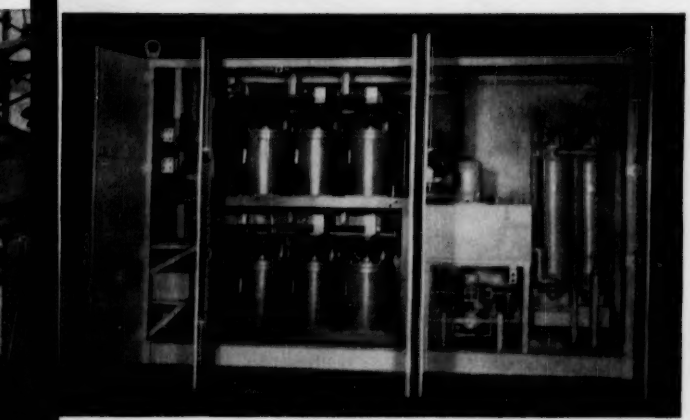
Discuss your plans with your Westinghouse Sales Engineer, or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

MP-3054

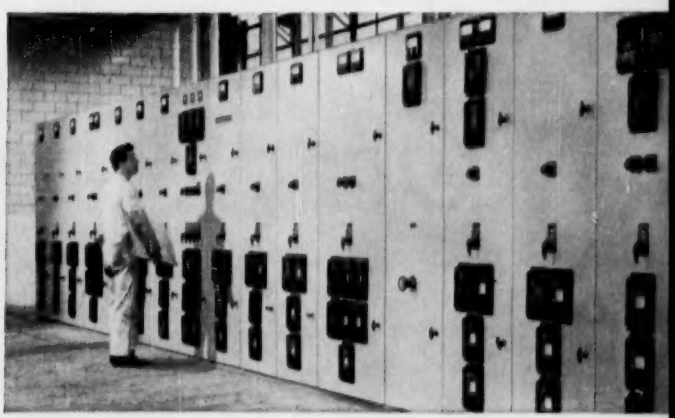
YOU CAN BE SURE...IF IT'S Westinghouse



2. Westinghouse oil circuit breakers with automatic reclosing equipment can automatically restore service to protect incoming lines or feeder circuits from prolonged and costly outages.



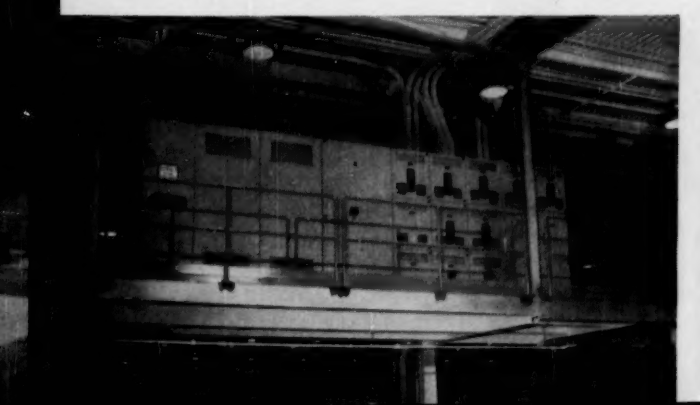
3. High availability and low maintenance of Westinghouse Ignitron Rectifiers has resulted in electrochemical installations totaling millions of kilowatts. Units are completely metal enclosed and factory assembled for low installation cost, minimum floor space.

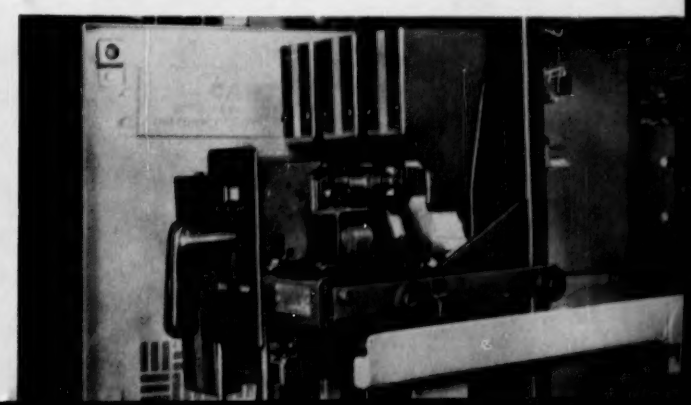


4. Westinghouse Metal-Clad High Voltage Switchgear provides unusual safety through interlocking devices and full steel barriers in a completely compartmentalized design.

5. Westinghouse unitized dry-type power centers solve the problem of handling increased power loads economically. They cost less to install because they do not require expensive enclosures and can be located close to the center of the load. For expansion, install additional breakers in spare feeder compartments.

6. Westinghouse low-voltage switchgear design provides an unusual degree of flexibility. This results from modern selective tripping. You get perfect coordination of time-delay characteristics, which confines outages to the faulted section alone.





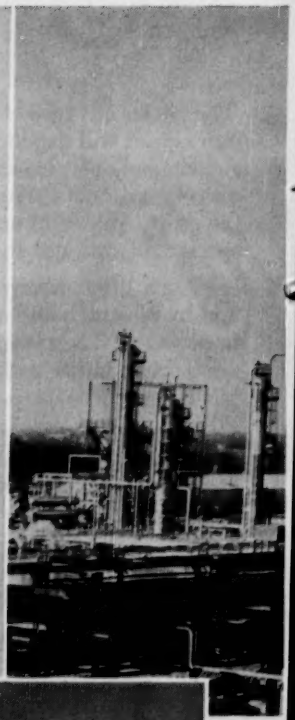
GIANT TIDEWATER REFINERY HAS ALL THREE

PROTECTION

CONTROL

MEASUREMENT

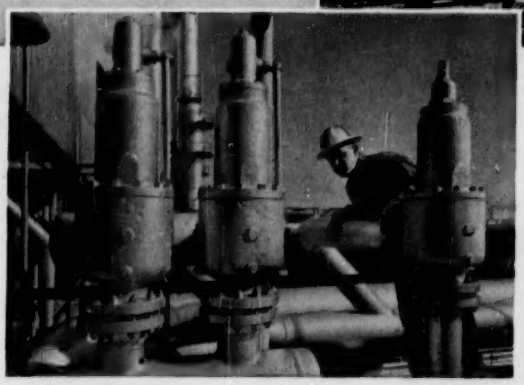
with reliable products of Manning, Maxwell & Moore



The Tidewater Oil Company's mammoth new Delaware Refinery is rightly referred to as the "refinery of the future." C. F. Braun & Co., engineering contractors, built the plant on the 5,000 acre site. Most of the processing units are unequalled anywhere for size and capacity. Tidewater incorporated the most advanced design and equipment to assure the greatest flexibility, economy and safety.

To provide around-the-clock protection, control and measurement, this ultra-modern refinery makes full use of dependable Consolidated Safety Relief Valves, Hancock Valves and Ashcroft Pressure Gauges. These products of Manning, Maxwell & Moore are precision engineered and built to insure the perfect performance, freedom from costly maintenance and long-life service so vital to economical refinery operations.

Whether you are modernizing or enlarging your plant for increased capacity . . . whether you are scheduling a "turn-around," planning a new processing unit or adding storage facilities – call on Manning, Maxwell & Moore regarding problems in protection, control and measurement. District offices and industrial distributors in the United States and Canada as well as agents and manufacturing licensees throughout the world are ready to serve you.



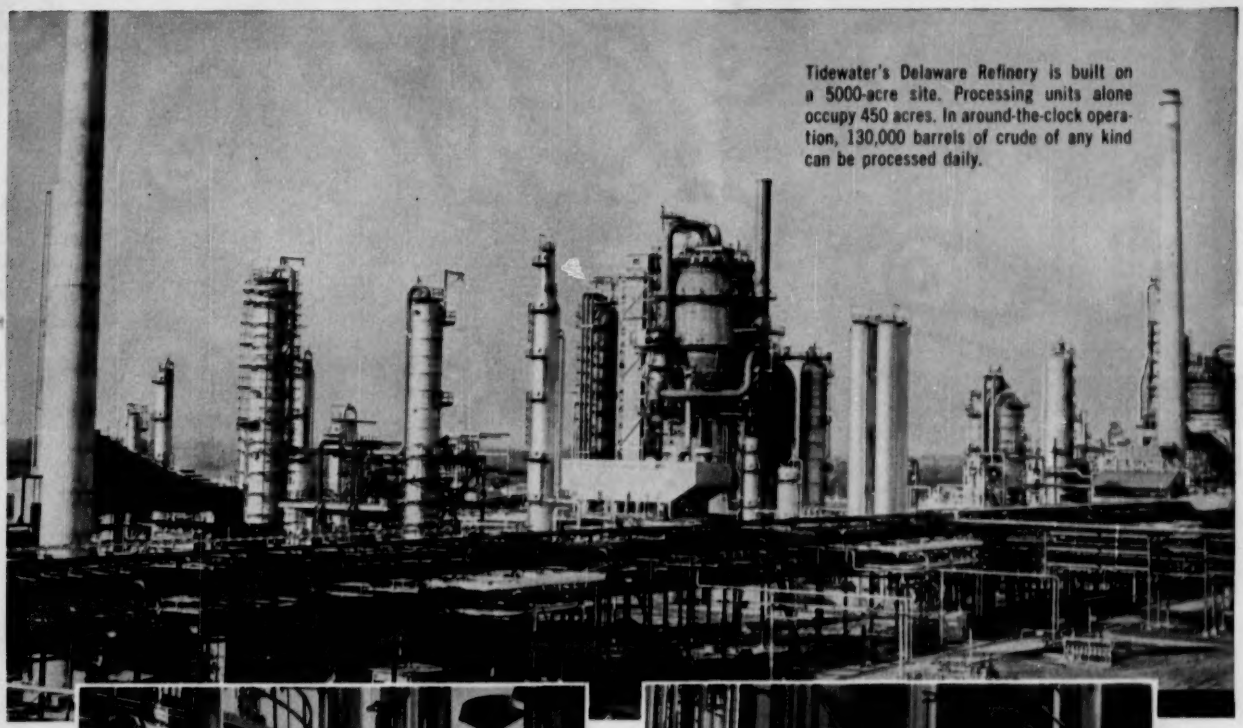
PROTECTION

. . . by CONSOLIDATED SAFETY RELIEF VALVES. The Orthoflow fluid catalytic cracker at Tidewater's Delaware Refinery is the world's largest. It is equipped with Consolidated Safety Relief Valves as are the propane storage bullets. These valves assure absolute protection through peak performance and consistently positive action, even where "superimposed" back pressure is in the relieving system.

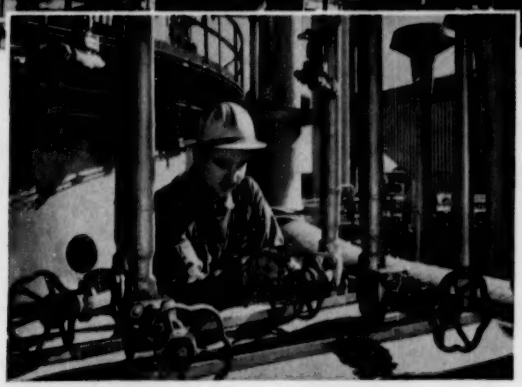
Consolidated Safety Relief Valves are "2 in 1" valves with interchangeability so highly perfected that the Standard valve can be converted to the Balanced Bellows Seal type *in the field*. Standardized inlet and outlet face-to-face dimensions permit these valves to be interchanged with those of some other manufacturers.

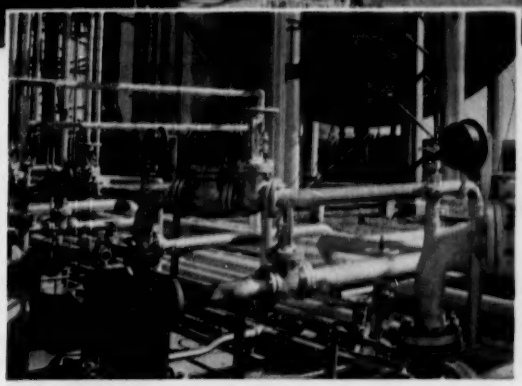
Fewer functional parts and precision machining and alignment of parts assure long valve life and less maintenance.

MANNING,



Tidewater's Delaware Refinery is built on a 5000-acre site. Processing units alone occupy 450 acres. In around-the-clock operation, 130,000 barrels of crude of any kind can be processed daily.





CONTROL

. . . by HANCOCK VALVES. The fluid-handling systems in Tidewater's Delaware Refinery must be kept at highest operating efficiency. To help control flow in the vast network of "fluid highways," hundreds of Hancock Valves are installed.

These manually-controlled valves are designed and built to give reliable performance under the pressures, temperatures and piping strains common to the most modern processing plant. All materials used in their construction are carefully selected — rugged strength and durability are engineered into every component. The super-hard seating surfaces are highly resistant to galling, steam cutting, wire drawing, erosion and corrosion. Positive tightness — leak-proof tightness — is assured month after month. Maintenance requirements are reduced to a minimum. Long-life service proves that there is no substitute for the economy of quality found in all Hancock Valves.

MEASUREMENT

. . . by ASHCROFT PRESSURE GAUGES. Accurate pressure measurement is essential to maintain product quality . . . to assure capacity performance of equipment and economical production in Tidewater's Delaware Refinery. Ashcroft Duragauges are precision instruments. They employ rotary geared motion — the most efficient and perfect method of transmitting mechanical motion. A choice of stainless steel movement or stainless steel with nylon bearings and pinion gear permits selection to meet specific requirements. Eight different Bourdon tube materials are available. Each Bourdon tube is "whip tested" at pulsating pressures approximately 50% higher than its pressure rating to insure calibration stability. Three case designs and materials and a complete range of dial sizes and pressures also provide for every individual need. Highest sustained accuracy and long service life are assured.

MAXWELL & MOORE, INC.

CONSOLIDATED ASHCROFT HANCOCK DIVISION

STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.*, 'HANCOCK' VALVES, *Watertown, Mass.*, 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.*, AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.* **In Canada:** *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*



KIDDE'S NEW DRY CHEMICAL EXTINGUISHER...





EASIEST, FASTEST WAY TO KILL FIRE!

Here – from Kidde – is the newest, the fastest, the easiest-to-operate dry chemical fire extinguisher.

Look at the extra large, aluminum handle and trigger – even a gloved hand fits comfortably with room to spare. Pick the unit up – it hangs straight – no awkward angle to throw you off balance.

If fire strikes, follow the simple directions: "Remove Horn" – automatically the trigger safety lock is released – "Pull Trigger" – instantly a cloud of fire-killing dry chemical whooshes out of the nozzle and fire's out! With this unit, designed by Kidde engineers working with Henry Dreyfuss personnel, you don't have to be a trained fireman to get perfect results.

Built for a lifetime of use, the handsome new 20 and 30 pound Kidde dry chemical extinguishers have top ratings from Underwriters' Laboratories, require only 225-250 psi charging pressure. The rugged pressure gauge is recessed in handle for maximum protection. Tells at a glance if the unit is ready for use.

Available nationally through Kidde's sales and service organization. Write Kidde today for the name of nearest distributor.

Walter Kidde & Company, Inc., 928 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal – Toronto

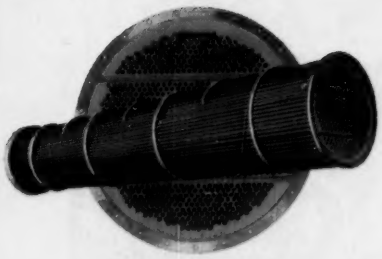
Kidde

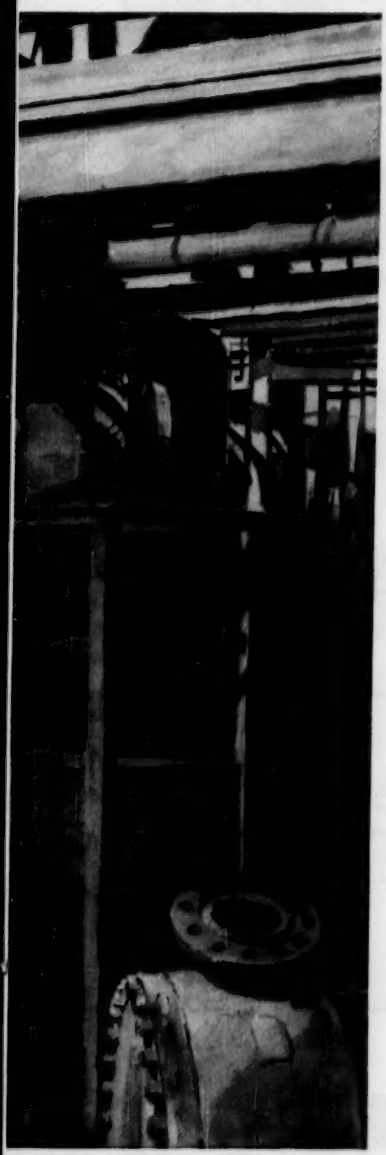
RETUBE YOUR BUNDLES WITH | PHELPS DODGE

HEAT EXCHANGER AND CONDENSER TUBES

FOR LONG-RUN RELIABILITY!







- Wide range of finest quality copper-base alloys—bi-metal combinations—to fit your application needs.
- Well-stocked, nation-wide warehouses at Houston, Tulsa, Los Angeles and Bayway, N. J.
- Experienced engineering staff at your service to help solve tube corrosion problems.

Specify Phelps Dodge . . . a leading manufacturer of tubes for the fabricators of heat exchangers and condensers!

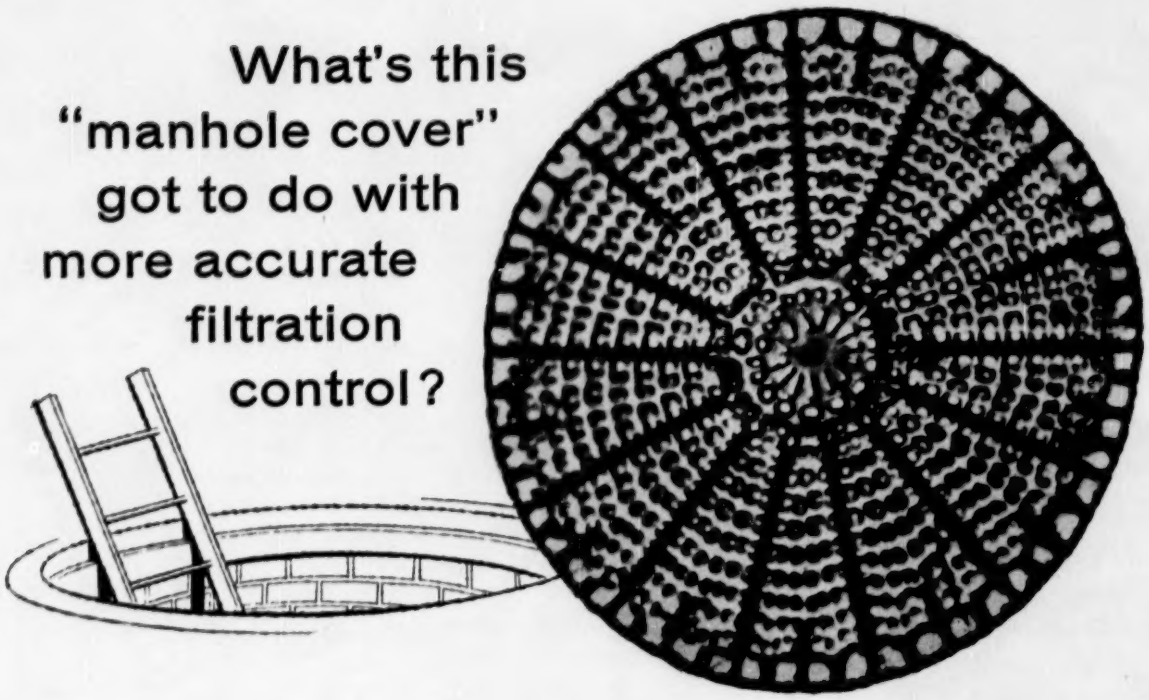
PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

FIRST FOR LASTING QUALITY—FROM MINE TO MARKET!

THIS "MANHOLE COVER" is really a magnification of *Arachnoidiscus ornatus*, one of the hundreds of different intricate particles that make Celite such an effective filter aid.

What's this "manhole cover" got to do with more accurate filtration control?



It's a particle of CELITE with the



The photomicrograph at left shows the wide variety of particle shapes and sizes in a typical Celite sample. By carefully controlling the proportions of particle sizes, the most complete range of grades is obtained.

Johns-Manville CELITE



Celite's wide range of grades permits precise control of several different filtration operations in the brewing of beer and ale. These include various ruh beer filtrations, wort filtration, final beer polishing and purification of brewing and bottle wash waters.



In industry's modern research laboratories, Celite filtration has proved itself an indispensable tool. Special grades of Celite have been developed that are particularly effective in analytical methods requiring filtration or chromotographic study.



In the manufacture of lubricating oils, Celite filter aids completely remove bleaching clay from the oil itself and also clarify the many additives used by the industry.

-the diatomite filter aid widest range of grades

Need maximum clarification? Use Celite* Filter-Cel. Or does your filtration require the fastest flow rates? Then use Celite 545. In addition, there are 7 more intermediate grades plus many special grades produced for specific applications. Thus, with Celite, you can establish the exact balance of clarity and flow rate that your process requires. No other diatomite gives you such a wide choice of grades.

Celite also gives you other important advantages over competitive filter aids. Its lower wet density provides greater surface coverage per pound. This means substantial savings because six bags of Celite actually do the work of seven bags of other diatomites.

And Celite is uniform. Every pound of Celite comes from the world's largest and purest commercially available diatomite deposit. Every pound is processed and graded at the same plant under the same conditions. Yet, with the large inventory maintained at the plant and Johns-Manville's nationwide network of warehouses, you're assured of fast, sure delivery.

So, if filtration belongs in your processing operations, it will pay you to call in your local J-M Celite engineer. Backed by Johns-Manville's research facilities and years of practical diatomite experience, he can help you with your filtration problems. Call him today or write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

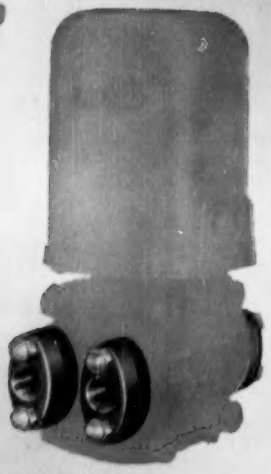
Diatomite Filter Aids

JOHNS-MANVILLE J-M PRODUCTS



FOXBORO d/p CELL

unequaled –



Simplest installation — orifice flange tap connections at standard spacing, are provided at both ends.



Drain and vent holes at lowest and highest points on both sides.



Purged cover protects transmitter from weather, dust, and fumes.

Over 60,000 now in use!

No zero drift . . . positive overrange protection . . . high sustained accuracy even under the most punishing operating conditions. No wonder over 60,000 Foxboro d/p Cell Transmitters have been installed since they were introduced in 1948.

By introducing the modern concept of high speed flow measurement and control, these differential pressure transmitters have *revolutionized* many an industrial process. Bulletin 13-11A shows how — and portrays the benefits the d/p Cell Transmitter offers you. Write **The Foxboro Company, 369 Neponset Ave., Foxboro, Mass., U.S.A.**

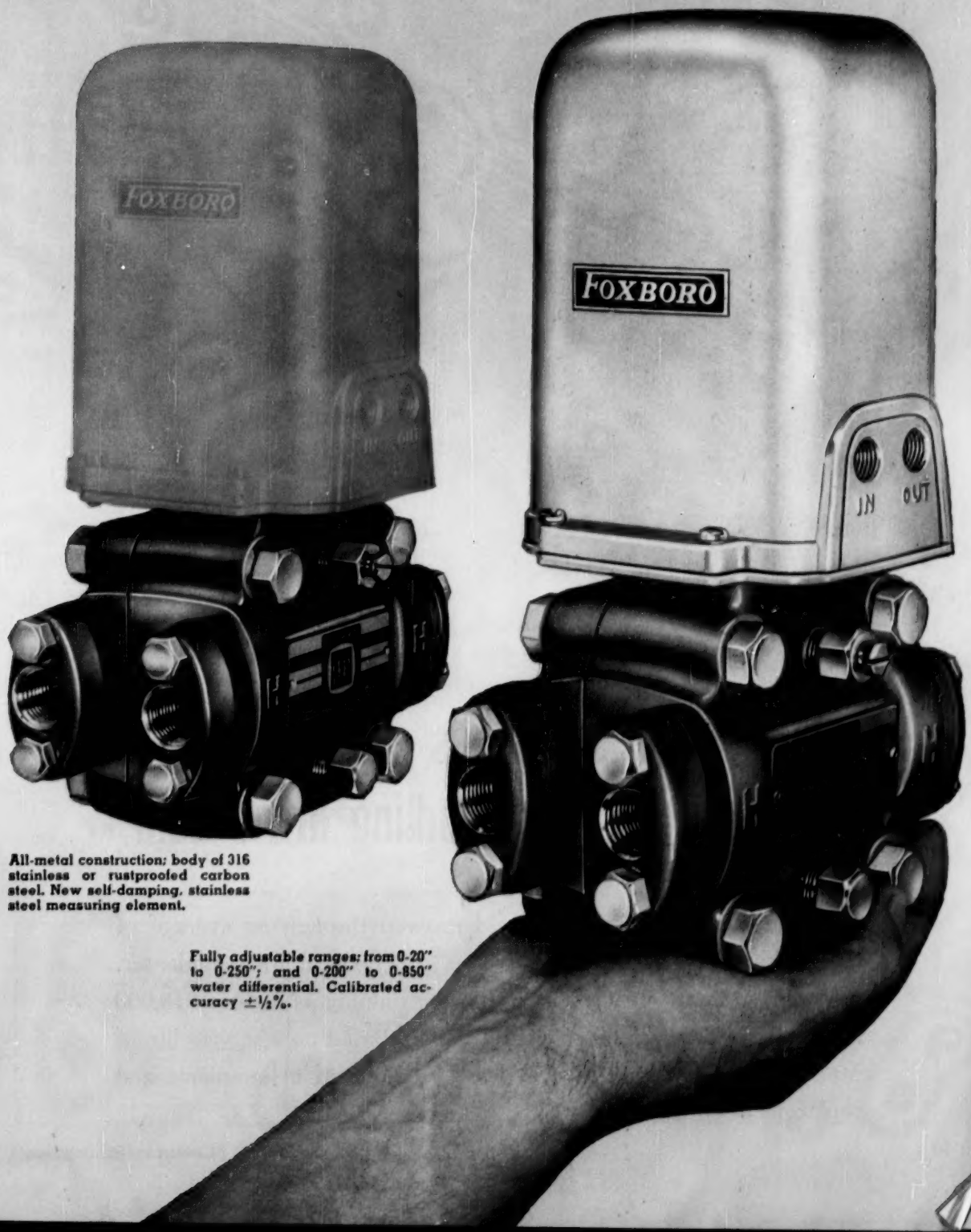
FOXBORO

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FIRST in Flow Measurement and Control

FLOW TRANSMITTERS...

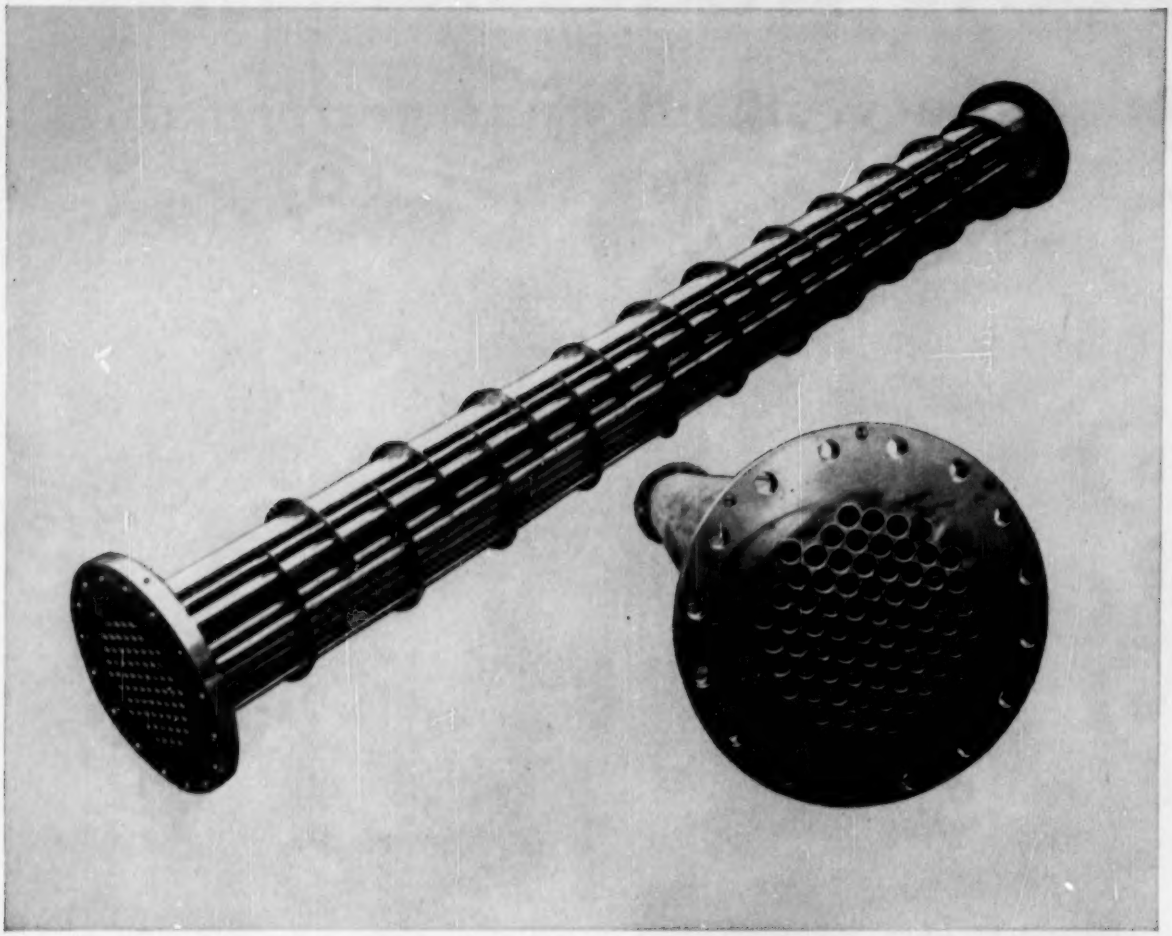
in accuracy, stability and performance



All-metal construction; body of 316 stainless or rustproofed carbon steel. New self-damping, stainless steel measuring element.

Fully adjustable ranges: from 0-20" to 0-250"; and 0-200" to 0-850" water differential. Calibrated accuracy ±½%.

TITANIUM–available now for long service



• *The life of this titanium 70-tube condenser assembly, now handling 60% nitric acid at 195° C. and 180 psi, is estimated to exceed 10 years.*

Titanium condenser tubes expected to outlast stainless 30 to 1 handling nitric acid

Corrosive vapors of 60% nitric acid gnawed through an average of three stainless-steel tube bundles a year in a chemical firm's condenser. Maintenance and replacement costs were running as high as $18,000 a year. Then titanium tubes were installed. Based on a service life of 10 years, titanium will save at least $162,000 in maintenance and replacement costs.

life . . . corrosion resistance . . . economy in use

Proven economies

Titanium is actually the *least expensive* metal you can use under many corrosive influences. Titanium withstands conditions that reduce the service life of ordinary metals . . . assures minimum downtime of equipment, fewer replacements.

Titanium offers the economy of long, trouble-free service when exposed to such corrosive environments as:

Salt Water	**Most Inorganic Chloride Solutions**
Marine Atmospheres	**Molten Sulfur**
Nitric Acid	**Chromic Acid**
Wet Chlorine	**Aqua Regia**
Chlorinated Organic Compounds	**Hypochlorites & Chlorine Dioxide**

TITANIUM—available today

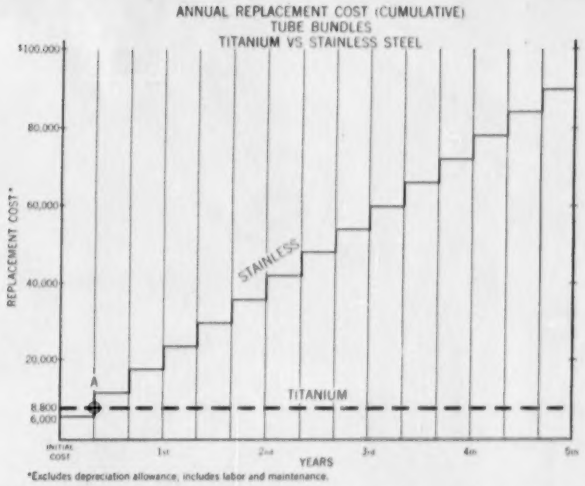
Titanium is now readily available for non-defense applications. Through research and technical developments by process-equipment manufacturers and mill-product producers in cooperation with Du Pont, standard parts can now be made to specifications. Titanium equipment is already solving severe corrosion problems in a number of industries—chemical, food, pulp, paper and allied industries.

In your process-development work, take full advantage of the corrosion and cavitation resistance, light weight and high strength of titanium . . . important considerations for continuous flow, high temperature and pressure processes. For further information, get in touch with Du Pont. And be sure to mail coupon below for an informative booklet about titanium—its properties and applications. E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Titanium Market Development Section, Wilmington 98, Del.

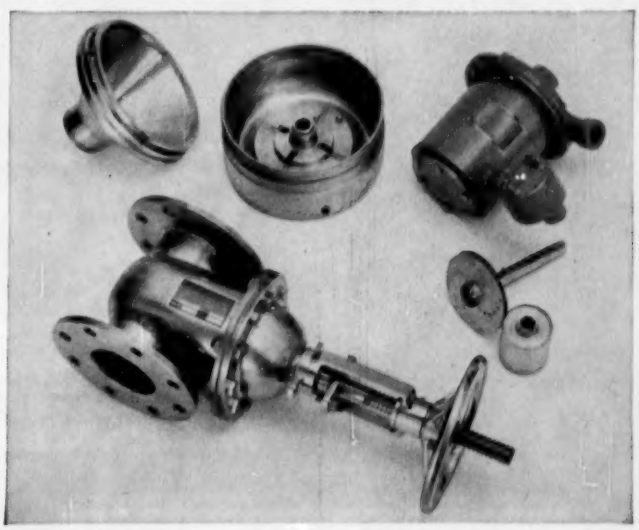
PIGMENTS DEPARTMENT

DU PONT
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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



INITIAL AND ANNUAL REPLACEMENT COSTS of titanium and stainless tube bundles are compared above. Initial cost of the titanium tube bundle, shown at left, is $8,800, vs. $6,000 for stainless. But note how the $2,800 difference is absorbed within 4 months of service (Point A). Savings are approximately $81,000 after 5 years . . . $162,000 after 10 years, the expected service life of titanium tubes.



NOW AVAILABLE, titanium parts and fittings like this 4" gate valve, chemical pump and centrifuge can be made to your order by process-equipment fabricators.



If you have a corrosion problem and need additional information, mail this coupon for titanium booklet.

Please send me more information on titanium. I am interested in evaluating titanium for these applications:

_____

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E. I. du Pont de Nemours & Co. (Inc.)
Titanium N-2420-25, Wilmington 98, Delaware

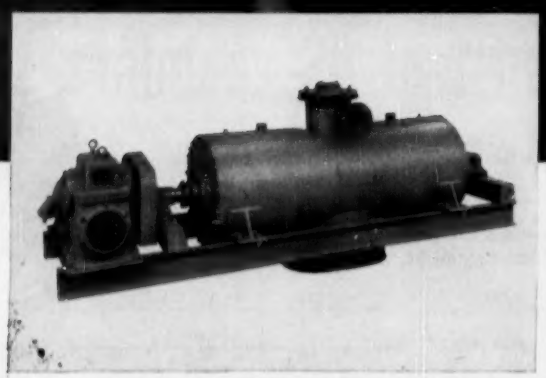
*Name*_____ *Title*_____

*Firm*_____

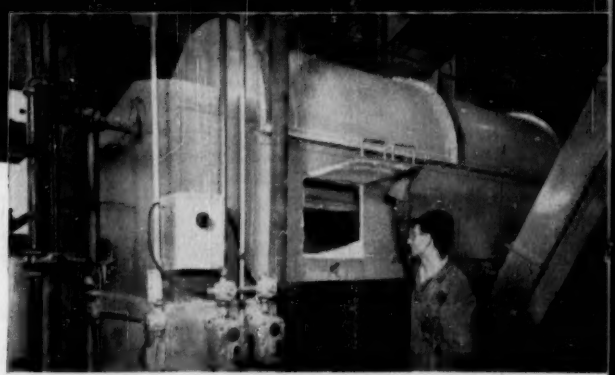
*Address*_____

*City*_____ *Zone*_____ *State*_____

The Stokes Model 238-H Vacuum Shelf Dryer with 158 sq. ft. of drying surface. A complete line of standard size chambers are carried in stock . . . are fitted with internal shelves to suit your requirements.



Rotary vacuum dryers are used for fast, thorough, uniform and economical drying of large batches with minimum labor. Heat is provided through the horizontal jacketed shell, and agitation through a center shaft. Solvent recovery can be had through condensation of the vapor. Broad range of sizes.



Drum dryers and flakers are used for continuous processing, at high rates, or materials that are not adversely affected by atmosphere. Material dries or solidifies on the heated or cooled surface of a revolving drum and is removed by a doctor blade. Wide selection of single and double drum models.

OTHER STOKES EQUIPMENT FOR CHEMICAL PROCESSING——

New Stokes Vacuum Shelf Dryers

can improve your products—

where development or production involves drying heat-sensitive, air-sensitive, or pyrophoric materials . . . or materials that require drying without agitation

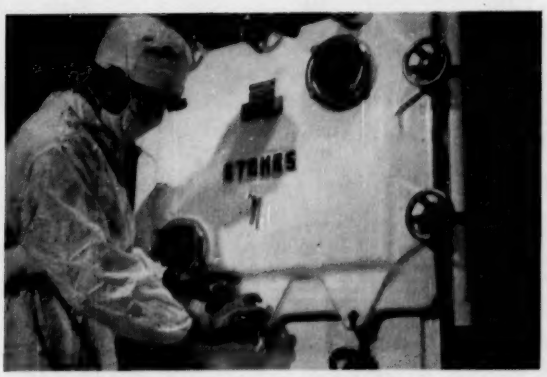
Vacuum shelf drying offers many outstanding advantages where these product characteristics create problems in process or quality control. Heat-sensitive materials can be safely dried at low temperatures under vacuum, since the environmental pressure is reduced below the vapor-pressure of the contained water or solvents. Oxidation or contamination by air, and solvent explosion hazards are eliminated. Recovery of expensive solvents can be virtually complete.

The vacuum shelf drying technique eliminates agitation and mechanical friction from processes involving materials which must remain dormant during the drying period. It also provides a safe environment for drying pyrophoric materials such as zirconium and titanium.

Arranged for heating by hot water, steam or special heat transfer fluids, the new Stokes shelf-dryer design carries ASME Code Certification on all pressure parts as a standard feature. Fabrication is from ASME Code-inspected materials by Code-certified welders, with inspection according to ASME Code procedures.

In another major design improvement, all manifold connections are outside the chambers, avoiding all risks of leaks and product contamination within the chambers. Initial costs of shelf-drying systems are low . . . an important factor where quantity requirements are relatively small.

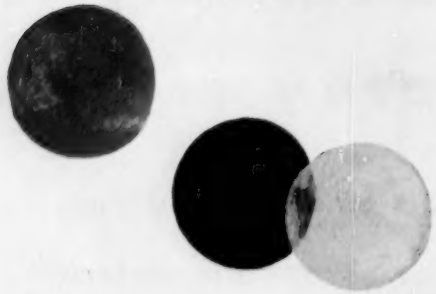
The Stokes 238 line of vacuum shelf dryers are part of a broad line of equipment for the chemical and processing industries. Stokes maintains a complete applications and process development laboratory for analysis of the requirements of your products. Write to Stokes or contact your nearest Stokes office.



Vacuum freeze dryers preserve potency and volatile constituents in many materials by converting them to a dehydrated form that maintains cell structure. Materials possess remarkable solubility and rapid reconstitution to original form. Sizes for laboratory, pilot plant and production.

Vacuum Processing Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

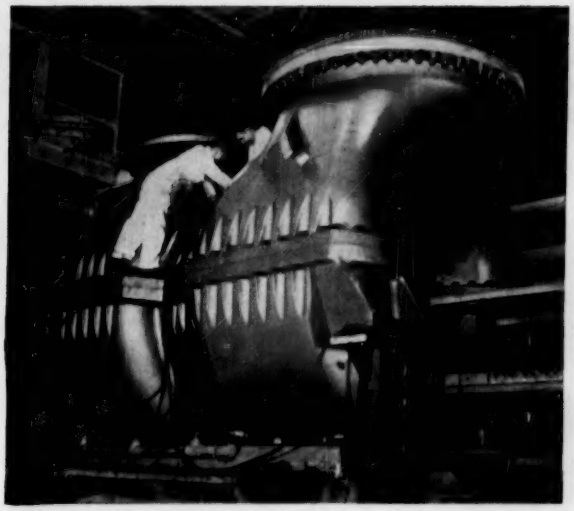


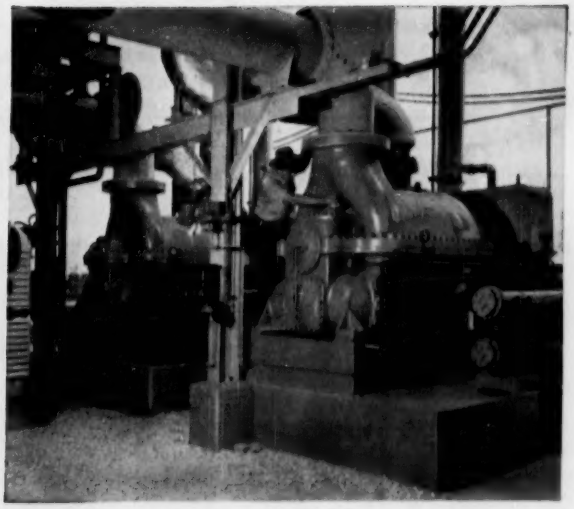
Which is the best way to process gas?



That depends on the type of gas, its volume, its pressure, and its temperature. The machine that's right for one process may not be the best for another. With the widest selection of equipment in the field for compressing gas or condensing it, Carrier has the right machine for your process. Here are four of them—each fitting different objectives. Only Carrier makes all four and can give you an impartial recommendation. For complete information call your nearest Carrier office. Or write Carrier Corporation, Syracuse, New York.

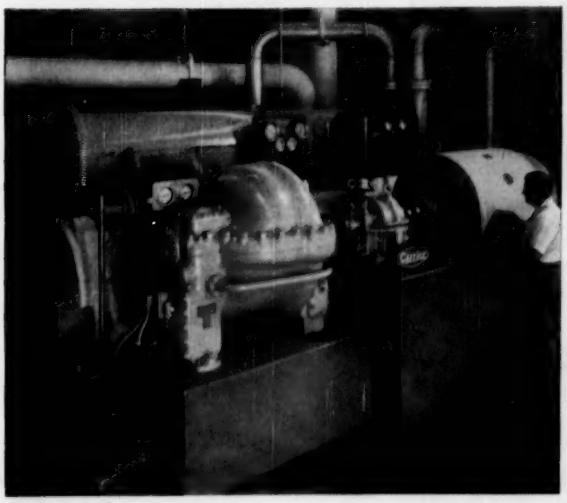
Carrier

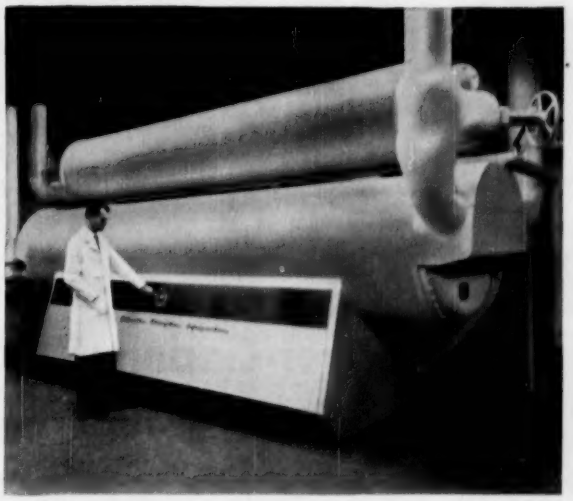




If you need large volume flow, Carrier Axial Flow Compressors offer distinct advantages. Their high efficiency effects a significant reduction in operating costs. And their dependability is proved—the hundreds now in use have given reliable service for a total of 60 million operating hours. Frame sizes are rated up to 600,000 cubic feet per minute when operating on air.

If you need high pressure, Carrier offers a complete line of Centrifugal Compressors for air and gas compression. Their ability to run continuously day in and day out has been demonstrated in many processes in scores of chemical plants and petroleum refineries throughout the world —processes such as catalytic cracking; chemical synthesis; air, gas and oxygen compression.





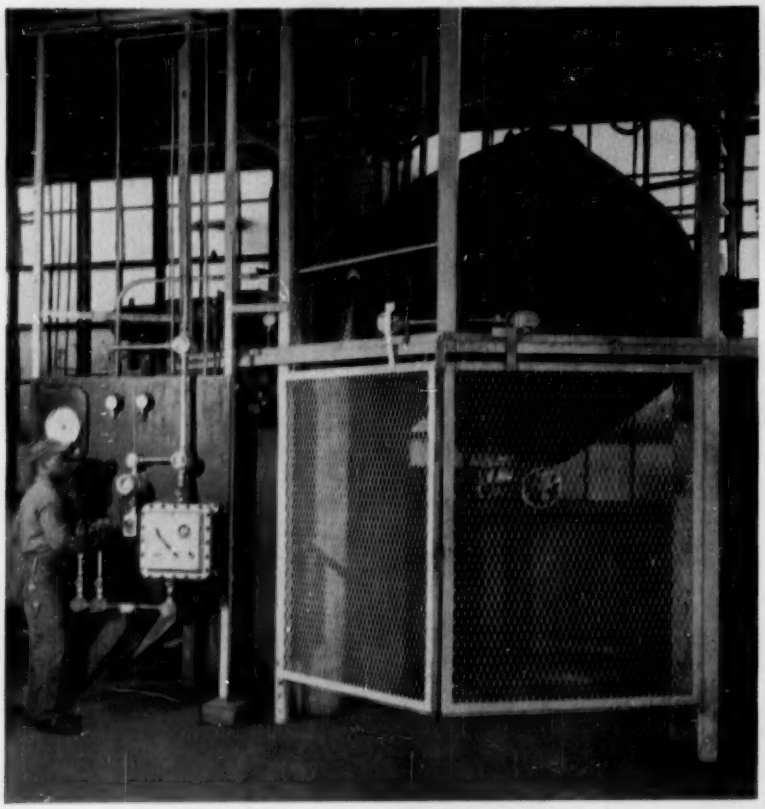
If you need sub-zero refrigeration, Carrier Centrifugal Refrigerating Machines provide accurate, automatic control of temperature 24 hours a day, year around. Besides chilling to ultra-low temperatures, they can be used for petroleum and chemical processes such as lean oil cooling, alkylation, dewaxing, vapor condensing and liquid or brine cooling. Up to 4000-ton capacity.

If you have low-cost steam or hot liquids, Carrier's new Absorption Refrigerating Machines cool water or process streams with heat energy derived from low-pressure waste steam or hot liquids for substantial savings. Operate automatically, follow fluctuating loads from full to zero capacity. Ideal for economical lean oil or chemical solution cooling. Capacities from 60 to 700 tons.

Titan Superjectors—continuous-type centrifuges—operate as long as a month without shutdown for cleaning. SEE BACK COVER OF THIS ISSUE.

Pfaudler

Pfaudler Corrosioneering News Published by The Pfaudler Co., Rochester, N.Y.



The Pfaudler conical dryer-blender eliminates losses from material flying off in the air. No manual handling of the contents is required as the receiving container can be placed neck to neck with the discharge opening.

Toms River-Cincinnati Chemical reduces dyestuff drying time by 90%

A particular problem at the Cincinnati plant of the Toms River-Cincinnati Chemical is drying dyestuff intermediates that are sensitive to air absorption at elevated temperatures.

Drying time has been reduced from 36 hours, required for chamber drying, to 4 hours using a Pfaudler glassed steel conical dryer-blender. In the tumbling action of the Pfaudler conical dryer-blender, the drying is simultaneous throughout the charge, drastically cutting 90% off the time required for each batch. In addition, a better product is obtained because the material is exposed to elevated temperatures for a much shorter period.

Labor costs per pound of material handled have been reduced by 50%. The material to be dried is introduced directly into the drying chamber of the Pfaudler conical dryer-blender. There's no intermediate manual handling required.

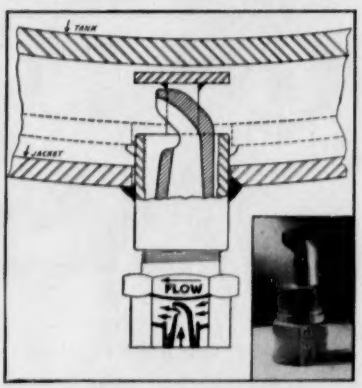
The corrosion and contamination problem associated with chamber drying is completely eliminated with the Pfaudler conical dryer-blender. The material is poured directly into the glassed steel drying chamber which protects the contents against contamination and prevents corrosion of equipment.

Because the dyestuff intermediates have a very fine consistency, unloading from the pans is a very dusty operation, and is accompanied with some losses. With the Pfaudler conical dryer-blender, the material is removed from the bottom. The neck of the receiving container is neck to neck with the discharge opening.

If your present drying cycles are too lengthy, if your product requires more thorough blending, and/or if you are faced with corrosive attack of existing equipment, it will pay you to examine the tremendous advantages offered by the Pfaudler glassed steel conical dryer-blender. You can use them for every kind of acid except hydrofluoric and hot concentrated phosphoric—for all alkalies up to pH 12 at 212° F.

Sizes range to 165 cu. ft. working capacity and are available in four different diameters: 2 ft., 4 ft., 6 ft., and 8 ft. You can test your products in our laboratory or in your plant with a Pfaudler loan unit. Send for Data Sheet 26. It will give you all the details.

New data on turbulent flow in reactor jackets



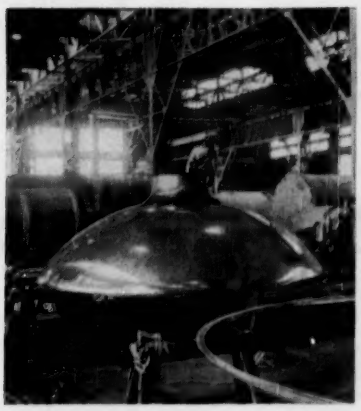
Capacities and characteristics of the Pfaudler Agitating Nozzle and its superiority over the commonly used spiral jacket are discussed in a new bulletin No. 950. Working basis for the agitating nozzle is the use of kinetic energy. This is available through the pressure and volume of the heating or cooling liquid delivered to the

Corrosioneering News

Quick facts about services and equipment available to help you reduce corrosion and processing costs.

reactor as a direct means of producing circulatory movement of entire contents of jacket. Capacity chart and typical hookup of nozzles are shown. Method of selecting nozzles is fully covered. Ask for Bulletin No. 950.

Custom-built copper and copper alloy process equipment



Pfaudler can fabricate copper or copper alloy vessels to your process requirements.

If your process involves acid solutions of low oxidizing capacity, copper or copper alloys may be one answer to your equipment construction problem.

As corrosion specialists, Pfaudler fabricates numerous metals and alloys, including copper and copper alloy vessels and tanks. With many years experience in brewery equipment manufacture, where copper is widely used, Pfaudler coppersmiths are second to none. Their craftsmanship is attested to by the long-term performance record of their wares.

For large or small equipment, Pfaudler copper manufacturing facilities are complete and economical. If you require heat treating, our furnace capacities will handle vessels up to 13 feet in diameter by 45 feet in length.

Discuss your next custom copper fabrication with Pfaudler too.

The corrosion resistance of glassed steel to acids

The resistivity of Pfaudler's glassed steel is comparable to that of laboratory glassware. With it you can duplicate laboratory results in production operations.

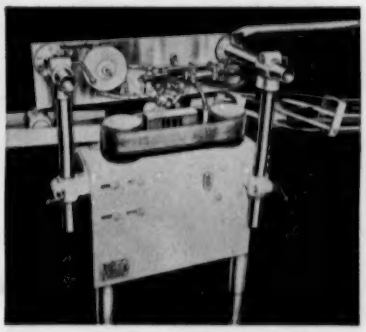
While glassed steel is inert to a wide range of operating conditions, there are factors that must be understood about its resistivity to assure long-term use of equipment.

Product temperature and concentration are important factors. Pfaudler glass is fully resistant to all acids except hydrofluoric at temperatures up to 212° F. Above the boiling point, corrosion rates sometimes increase. However, certain acid solutions at temperatures as high as 450° F. have no effect on Pfaudler glass, while others are generally restricted to not exceed the boiling point.



Bulletin No. 928 will help you understand the versatility of glassed steel with nitric, acetic, sulphuric, hydrochloric and phosphoric acid solutions. (Check coupon for copy.)

Also, our research facilities are equipped to test your product and report on its corrosive characteristics.



Pfaudler Outsert Applicator attaches message to your package automatically.

Does your container sell the product?

Think of the merchandising value you could give your product by affixing a sales aid to the outside of the container.

Applications, recipes, coupons, premiums, etc., when placed outside the container, can demand consumer attention and develop shelf-prominence.

The new Pfaudler Outsert Applicator is the only automatic machine for attaching *outserts* to cylindrical, flat or tapered containers of glass, metal, paper or plastic construction.

Our engineers will gladly analyze your product and make recommendations. Forward one or two labeled containers along with your sales aid and we will take it from there. Bulletin No. 933 (check coupon for copy) gives you the details of the machine.

THE PFAUDLER CO., DEPT. CE-97 ROCHESTER 3, NEW YORK

Please send me: ☐ Data Sheet 26 "Conical Dryer-Blender." ☐ Bulletin 950 "Agitating Nozzles." ☐ Bulletin 928 "Corrosion Resistance Pfaudler Glass." ☐ Bulletin 933 "Outsert Applicators."

Name.....

Title.....

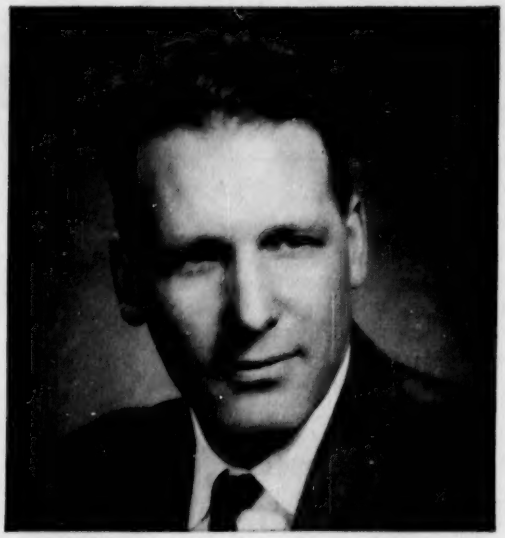
Company.....

Address.....

City..... Zone..... State.....



J. G. ZIEGLER, Pacific Coast Sales Engineer, a member of the Taylor Team of Instrumentation Scientists, is known internationally in his field. Together, the well-known team of Ziegler and Nichols have collaborated on such published papers as "Optimum Setting for Automatic Controllers," "Industrial Process Control," "Dynamic Accuracy in Temperature Measurement," "Valve Characteristics and Process Control," and many others.



N. B. NICHOLS, Chief Engineer, Taylor Instrument Companies, also has an international reputation as an instrumentation scientist. He was called to MIT during the war to work in the servomechanisms laboratory and later as group leader of the fire control division of the radiation laboratory. He edited a book on servomechanisms, and along with John Ziegler has authored a number of papers on the science of process control.

Bring your problems to these top

GEORGE E. HOWARD, Manager of the important Application Engineering Department of Taylor Instrument Companies, has had over 20 years experience in the design and application of engineered control systems, specializing in the Chemical, Petroleum and Textile Industries. During World War II Mr. Howard trained Government personnel on instrument operation and maintenance at the Government's Oak Ridge Atomic Energy Plant where Taylor was the prime contractor on instrumentation.



RICHARD N. POND, Vice President of the Instrument Society of America and a member of the Executive Board, has served the society in a variety of capacities since he first became active in the St. Louis chapter in 1946. He was secretary, and later chairman, of the committee on Instrumentation for Production Processing. He is a Divisional Sales Manager for his company, specializing in Oil Refining, Petrochemicals, Brewing, Power, Rubber and Plastics.



WE'RE FIELDING our first team at the ISA Show in Cleveland. There will be 27 top Taylormen there—the 4 shown and 23 listed below. We're proud of the ability and experience of this team.

They'll be there—with headquarters at Booth 949-955—to put their skills to work on your own specific instrumentation problems. These men, drawn from our application engineering and sales departments, take to the show broad backgrounds of successful experience in the solution of instrumentation problems throughout the processing industries. They will be there only because you are going, too—so, why not stop by and put them to work on your plant's problems?

These men are typical of the world-wide Taylor sales and engineering organization that stands ready to help you with your instrumentation problems. Taylor Instrument Companies, Rochester 1, N.Y., and Toronto, Canada.

Taylormen at the ISA Show!

J. E. Barber
G. F. Barnum
E. M. Barr
W. J. Berk
R. C. Brostedt
C. S. Conner
D. D. Decker
R. I. Edelman
A. J. Fleig
L. L. Forward
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G. E. Heller
H. W. Maurer, Jr.
R. F. Maurer
H. G. Olson
H. E. Rissinger
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INSTRUMENT SOCIETY OF AMERICA

Taylor Instruments
— MEAN —
ACCURACY FIRST

VISION · INGENUITY · DEPENDABILITY

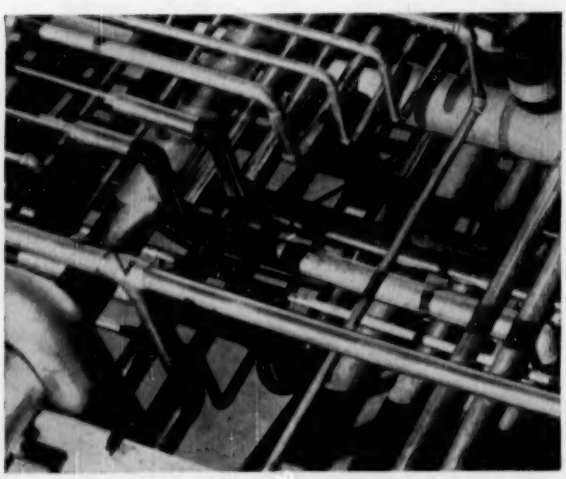
ALUMINUM the no-maintenance metal . . .

serves you better when you use Reynolds technical services and information

ALUMINUM is the natural choice for process industry applications. It has high resistance to corrosion — is unaffected by most plant atmospheres. Aluminum does not require protective maintenance to insure its long, useful life.

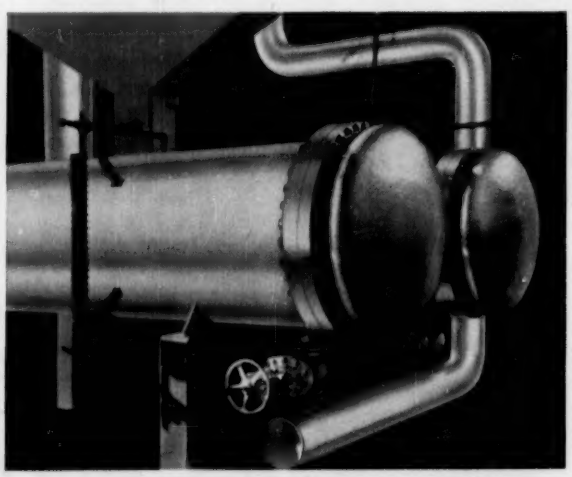
Aluminum makes construction faster and easier, thanks to its light weight and ease of fabrication. And it is non-sparking, amazingly strong, reflects heat.

For full information on how much Reynolds Aluminum can save for you, and how you can get Reynolds technical assistance, call the Reynolds office listed under "Aluminum" in your classified telephone directory. Or write direct *Reynolds Metals Company, P. O. Box 1800-CJ, Louisville 1, Kentucky.*
International Division, 19 East 47th Street, New York 17, N. Y.



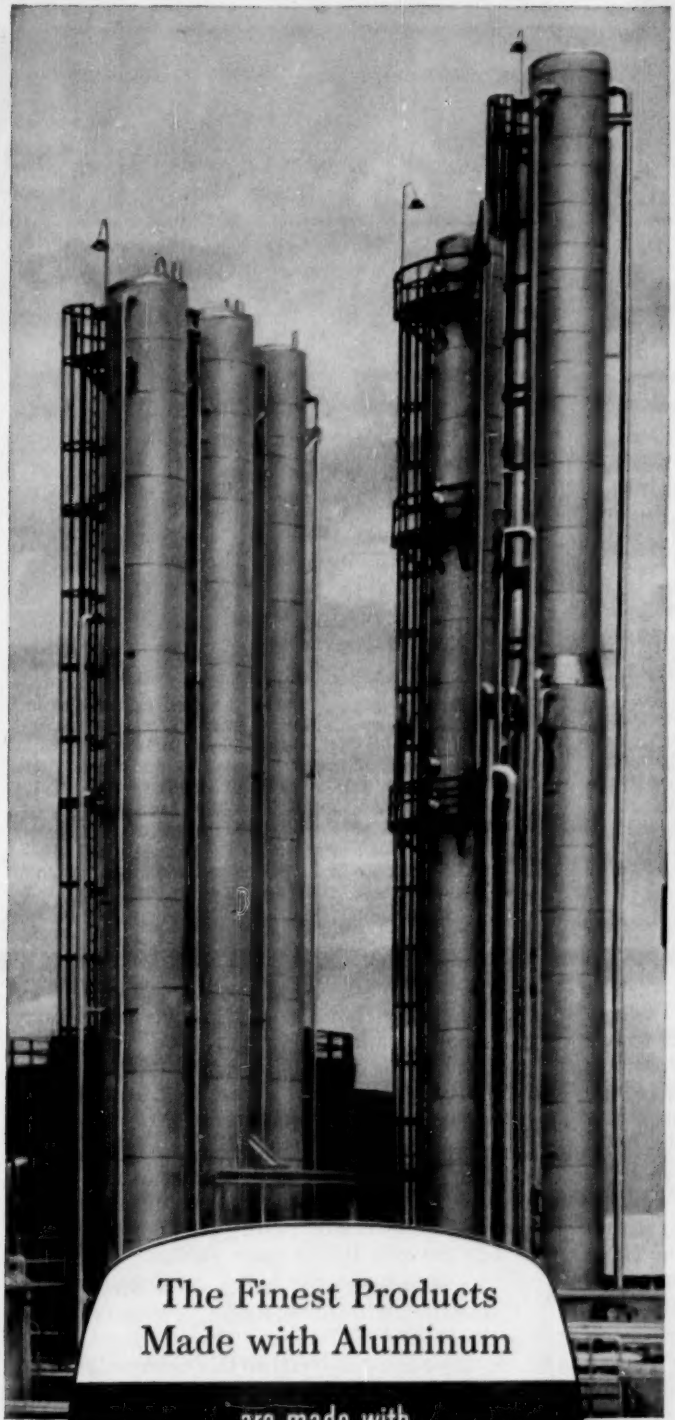
ALUMINUM PROCESS PIPE

Many chemical and petroleum processors call it the most economical corrosion resistant pipe available. Resists corrosive action of many process liquids and gases such as hydrogen peroxide, nitrogen solutions, many acids, alcohols and foods as well as sweet and sour crudes, other raw and refined petroleum products. Aluminum pipe is light, easily weldable, non-sparking. Write for Reynolds complete brochure on Process Pipe.



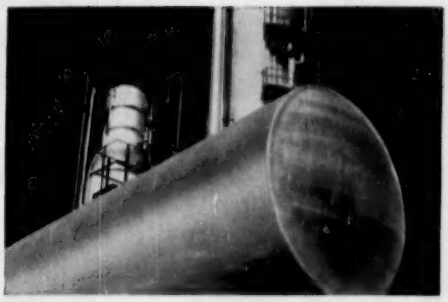
ALUMINUM HEAT EXCHANGER TUBING

Offers lower cost as its first advantage. Has less tendency to foul than other metals, providing longer periods between cleanouts and more lasting efficiency. Light weight reduces fabrication, installation and shipping costs. Aluminum is exceptionally well-suited to bundle and shell type exchangers. Recommended for use up to 400° F. Send for 16 page brochure, Reynolds Aluminum for Heat Exchangers.



The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

© REYNOLDS METALS COMPANY



ALUMINUM JACKETING
Gives plants new and lasting functional beauty. Eliminates costly periodic maintenance. Adds the product-protecting advantage of aluminum's natural insulating qualities. Now the standard jacketing material in many major plants.



ALUMINUM TANKS AND VESSELS
All-aluminum construction of tanks and vessels assures long life and great freedom from maintenance. Inert in the presence of most process materials, aluminum protects product purity. In these and many other process industry applications aluminum structurals, sheet and plate offer savings in construction and service. Write for Reynolds new brochure on Aluminum Tanks and Vessels.

ALUMINUM CHAIN LINK FENCING
Fenced areas require no preventive maintenance with aluminum chain link fencing. Resists corrosion even in the most active industrial atmospheres. Write for illustrated four color brochure containing specifications.

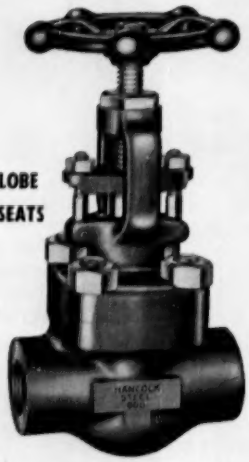
See "CIRCUS BOY", Sundays, NBC-TV.
Watch for Reynolds on "DISNEYLAND" ABC-TV.

REYNOLDS ALUMINUM

NEW 600# STEEL

NEW

TYPE 5500 — 600# GLOBE
INTEGRAL HARD-FACED SEATS
"500 Brinell"
Stainless Steel Discs.



Especially suitable for high pressure steam and temperature services in power plants. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel A.S.T.M. A-105 Gr. II. **Alternate Body and Bonnet Materials:** 1¼% Chrome, ½% Moly Steel, A.S.T.M. A-182 Gr. F-11. **Connections:** Screwed and Socket Weld Ends. For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F.

NEW

TYPE 5520 — 600# GLOBE
TYPE 5530 — 600# ANGLE
RENEWABLE "300 BRINELL"
STAINLESS STEEL SEATS
"500 Brinell" Stainless Steel Plug Discs.



Ideal for processing plants and general industrial service. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel A.S.T.M. A-105 Gr. II. **Alternate Trims:** 18-8 Type 316 Stainless Steel; Monel. **Alternate Body and Bonnet Materials:** 5% Chrome, ½% Moly Steel, A.S.T.M. A-182 Gr. F-5; 18-8 Type 304 Stainless Steel A.S.T.M. A-182 Gr. F-304. **Connections:** Screwed, Socket Weld and Flanged Ends. **Screwed and Socket Weld Valves:** For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. **Flanged Valves:** For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

These 600# bolted bonnet forged steel valves really make sense to every man who knows the economy of quality valves. Designed into them are plus values that substantially reduce profit-draining production shut-downs, maintenance problems and inventory costs. Built as companions to the widely-used Type 950 Hancock 800# Steel Gate Valves, they offer:

Thick, Rigid Body and Bonnet Flanges that can withstand more than ten times the rated pressure of the valve. The flanges butt — no bending, no distortion.

Re-usable Flexitallic Bonnet Gasket, in combination with the rigid body and bonnet flanges, prevents bonnet joint leakage. The gasket is a spiral-wound ribbon of stainless steel with asbestos filler and spring-like compressibility. It rests in a groove in the body flange — cannot blow out even if pressures exceed ten times the rating of the valve. *Hancock 600# Steel Valves are the first globe valves to use this important feature.*

Maximum Use of Stainless Steel. Even the stem, swing bolts, nuts, thread bushings and packing gland followers are stainless steel — your assurance of quality that saves throughout the long life of these valves.

The 5500 Line of Hancock 600# Steel Valves is available in Globe, Angle, "Flocontrol," Lift Check and Hi-Pressure Drop designs. Whatever your needs, you can buy these valves with complete confidence in their functional perfection. Like all other Hancock Valves, they are precision engineered and carefully manu-

HANCOCK VALVES

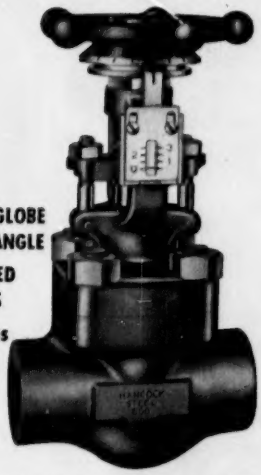
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PHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR. His broad knowledge and experience can be of real value to you. Let him help you select the right Hancock Bronze and Steel Valves for all your service requirements.

HANCOCK VALVES

NEW

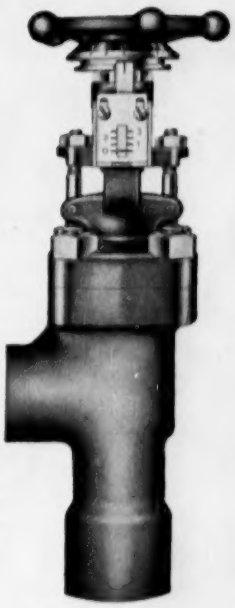
"FLOCONTROL"
TYPE 5525 — 600# GLOBE
TYPE 5535 — 600# ANGLE
RENEWABLE HARD-FACED STAINLESS STEEL SEATS
"500 Brinell" Stainless Steel V-Port Discs.



For general industrial service. Variable orifice, shut-off and index combined in a single valve. Any desired setting can be instantly duplicated. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel. **Connections:** Screwed, Socket Weld and Flanged Ends. **Screwed and Socket Weld Valves:** For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. **Flanged Valves:** For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

NEW

HI-PRESSURE DROP
TYPE 5505 — 600# ANGLE
INTEGRAL HARD-FACED SEATS
Stainless Steel Tube.



An orifice type valve, with shut-off and index in a single unit that permits the use of a smaller valve with a large capacity. Designed to withstand the terrific wrecking power of continuous blow-down. Also for use on feed-water, by-pass relief, in turbine washing processes, and where erosion is extremely severe. **Size:** 1". **Standard Materials:** Forged carbon steel. **Connections:** Screwed and Socket Weld Ends. For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. A.S.M.E. maximum boiler pressure 970 psi.

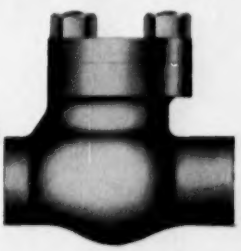
factured. You can be sure of long resistance to wire drawing, galling, steam cutting, erosion and corrosion — for leakproof tightness month after month. They surpass the toughest service demands of process and power piping systems in the most modern refineries, petrochemical, power and industrial plants. A high degree of standardization in all sizes simplifies both maintenance and inventory needs.

Let the durability, performance and economy of Hancock 600# Steel Valves save money for you. Whether you are adding facilities, building a new plant or setting up a revalving program, get all the reasons why these tough valves serve better and longer. Complete information is yours on request.

When Hancocks go in, valve costs go down

NEW

LIFT CHECK VALVE
TYPE 5540 — 600# GLOBE
RENEWABLE HARD-FACED STAINLESS STEEL SEATS
"500 Brinell" Stainless Steel Piston Discs.



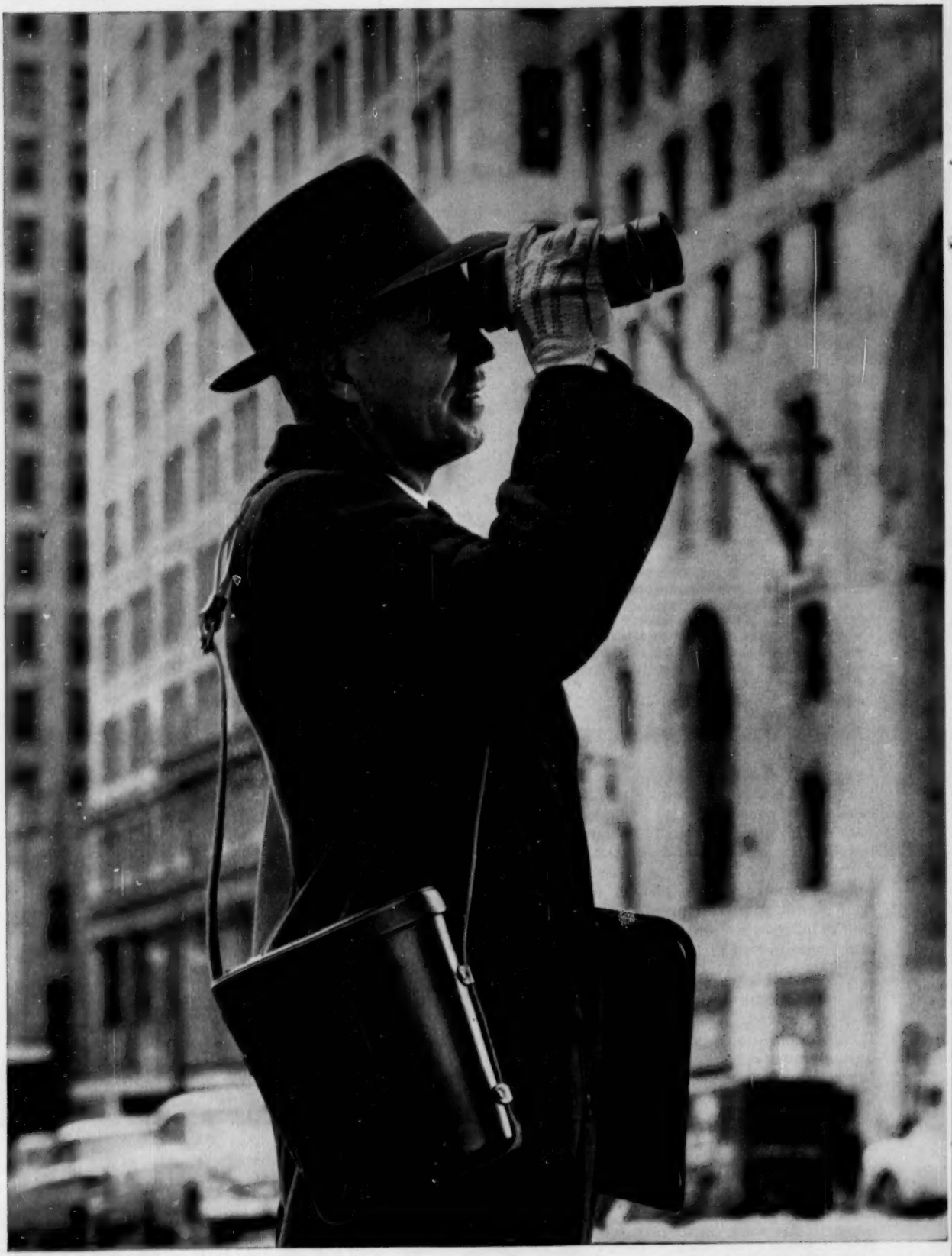
For general industrial service. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel. **Cap:** Bolted. **Connections:** Screwed, Socket Weld and Flanged Ends. **Screwed and Socket Weld Valves:** For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. **Flanged Valves:** For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

A PRODUCT OF MANNING, MAXWELL & MOORE, INC.

WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, California.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Michigan.*

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WYANDOTTE CHEMICALS CORPORATION, WYANDOTTE,



ARE YOU WATCHING THE PLURONICS GO BY?

The PLURONICS have already established themselves in many and varied commercial applications. Information is coming to us almost daily of other new and unusual ones.

How about you? Have you evaluated the PLURONIC* block-polymers thoroughly in your own laboratory?

PLURONIC block-polymers possess outstanding surface-active properties, and are easy to formulate because they blend readily with common builders. They permit you to compound cleaning products which are essentially dust-free and exceptionally free-flowing. But most important of all, they make it possible for your products to offer desirable and distinct advantages over yesterday's formulations.

Here are some rich rewards resulting from thorough evaluation of the PLURONIC block-polymers in other industrial fields: A paint manufacturer is controlling viscosity of latex systems . . . also using certain grades as dispersing agents for prime and extender pigments. Another paintmaker finds a PLURONIC particularly effective in improving the brushability of highly bodied latex paints.

In making resin-bonded grinding wheels, the PLURONICS are being used for wetting, plasticizing, adhesion.

In the preparation of emulsion muds for oil-well drilling, PLURONIC F68LF is used to keep viscosity low and the drilling rate high.

A PLURONIC is being used as a dye-leveling agent in the textile field for the dyeing of wool and synthetic blends.

But these are only a few of the many diverse uses of the various PLURONICS. You may be able to profit by them, too.

We'll help you. Send for a copy of our PLURONIC Grid, giving us as much background information as possible on the characteristics you're looking for, or the application you're interested in. We'll send data sheets and other technical information that will enable you to select the proper samples for your own particular product. Samples, of course, are available upon request. *REG. U.S. PAT. OFF.

MICHIGAN ALKALI DIVISION

WYANDOTTE CHEMICALS

Wyandotte Chemicals

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA • CHLORINE • MURIATIC ACID • CALCIUM CARBONATE • CALCIUM CHLORIDE • GLYCOLS • CHLORINATED SOLVENTS • SYNTHETIC DETERGENTS
OTHER ORGANIC AND INORGANIC CHEMICALS

MICHIGAN • OFFICES IN PRINCIPAL CITIES



8 big extras you get

WHEN YOU BUY

Bristol Instruments

Here's how Bristol can help you with an integrated, nationwide service organization



FACTORY REPAIRS AND SERVICE are available on Bristol instruments at San Francisco, Los Angeles, Chicago, Houston, and Toronto, as well as at Waterbury. Each reconditioned instrument carries a "new" guarantee.



EDUCATION FOR AUTOMATION. Instruction is offered in THE BRISTOL INSTRUMENTATION SCHOOL for customers' engineers and technicians on latest techniques in instrumentation. Widely attended, too, by professors from the leading technical schools.

1. FIELD ENGINEERING. Bristol field engineers are ready to serve you from offices located throughout the United States and Canada. Years of training and experience in applying instruments in all types of plants enable them to recommend the equipment best suited for your job. They call at your plant, without obligation or cost, to assist you in planning proposed instrument installations.

2. APPLICATION ENGINEERING. Our application engineering department includes specialists in every type of measuring or controlling instrument. These men are completely familiar with the abilities, limitations, and accessories of their particular specialty. And they know the methods of installation and operation that assure the best possible performance.

3. PROCESS SPECIALISTS. Process instrument experts, each a specialist in a particular industry, are ready to advise you on up-to-the-minute instrument systems for tough or unusual processes. Their correctly planned installations and accurately specified instruments save delivery and installation time and make for successful operation.

4. FIELD CHECK-UP SERVICE. A nation-wide staff of factory-trained, widely experienced Bristol service engineers gives you personal assistance in servicing your Bristol instruments. For a reasonable rate, they install, check, adjust, and inspect Bristol instruments in your plant. They are available on short notice—often within a few hours. Regardless of your location, Bristol service is "on call" at any time to help you get the most out of your Bristol instruments.

5. PERIODIC CHECK-UP SERVICE. A systematic plan of preventive maintenance and repair is available to users of Bristol instruments to keep their equipment in good operating condition. In this plan, a Bristol Service Engineer calls at regular intervals to inspect the instruments and make minor repairs before serious wear or damage can take place. These preventive measures guard against breakdowns at critical periods.

6. FACTORY REPAIR SERVICE. Factory repair facilities at San Francisco, Los Angeles, Chicago, Houston, Waterbury, and Toronto are available to repair, recondition and remodel Bristol instruments. All phases of fabricating, testing, calibrating, repairing, and remodeling Bristol instruments are performed at these branch factories by trained workmen, experts through years of experience in our production methods. Only genuine Bristol parts are used. *Each instrument reconditioned in any branch factory carries a new instrument warranty.*

7. FAST PARTS SERVICE. Service parts, such as may be needed in emergencies, are stocked by our branch offices. Everything possible is done to ship service parts and accessories promptly.

These big extras you get with Bristol instruments are good reasons—over and above outstanding basic instrument quality—why every Bristol installation gives such high accuracy and precision performance over an extremely long service life. When you buy Bristol instruments you can get service when you want it, regardless of where you are located. To find out more about Bristol instruments or service, write: The Bristol Company, 109 Bristol Road, Waterbury, Connecticut. 6.75

8. WRITE FOR BRISTOL TECHNICAL DATA—reputed to be the most outstanding present-day source of Instrument Engineering Data on the following subjects:

- Absolute pressure gauges
- Air-operated controllers
- Automatic control instruments
- Barometers
- Bridge instruments
- Combustion safeguards—electronic—Pyrotrol
- Coordinated process control—Process automation
- Cycle controllers
- Draft gauges
- Electric recorders
- Electrolysis survey recorders
- Electronic bridge instruments
- Electronic potentiometers
- Flow meters—Mechanical and Electric
- Gauges—pressure, vacuum, draft, absolute pressure, liquid level
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- Liquid level gauges
- Load totalizing with Thermoverter*
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- pH control instruments
- Pneumatic transmission systems; Metagraphic and Metavane*
- Potentiometers, electronic
- Pressure and vacuum gauges
- Process control instrumentation
- Pyrometers
- Recorder charts
- Resistance thermometers
- Smoke density recorders
- Specific gravity instruments
- Speed recorders
- Telemetering instruments
- Thermocouples, pyrometer tubes and accessories
- Thermometers
- Time-program controllers
- Valves, automatic

Ask for information on the subject of interest to you. We'll be glad to send it.

*T.M. Reg. U. S. Pat. Off.

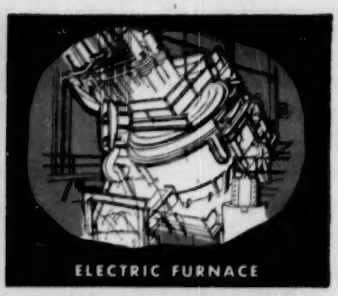
BRISTOL

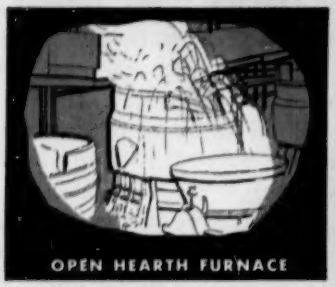
TRAIL-BLAZERS IN PROCESS AUTOMATION

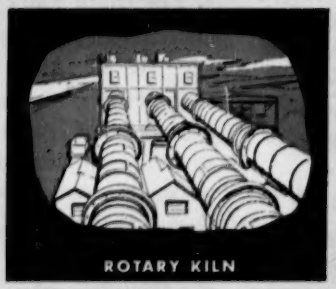
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

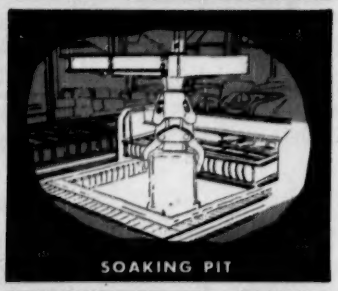

BLAST FURNACE


HEAT TREATING FURNACE


ELECTRIC FURNACE

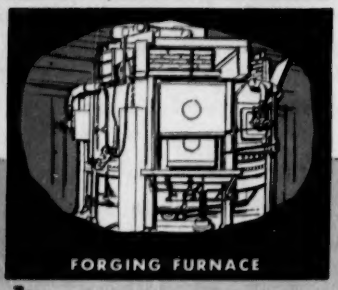

OPEN HEARTH FURNACE


ROTARY KILN


SOAKING PIT


TUNNEL KILN


COKE OVEN


FORGING FURNACE


GLASS MELTING FURNACE

Whatever may be your furnace requirements . . .

HARBISON-WALKER REFRACTORIES

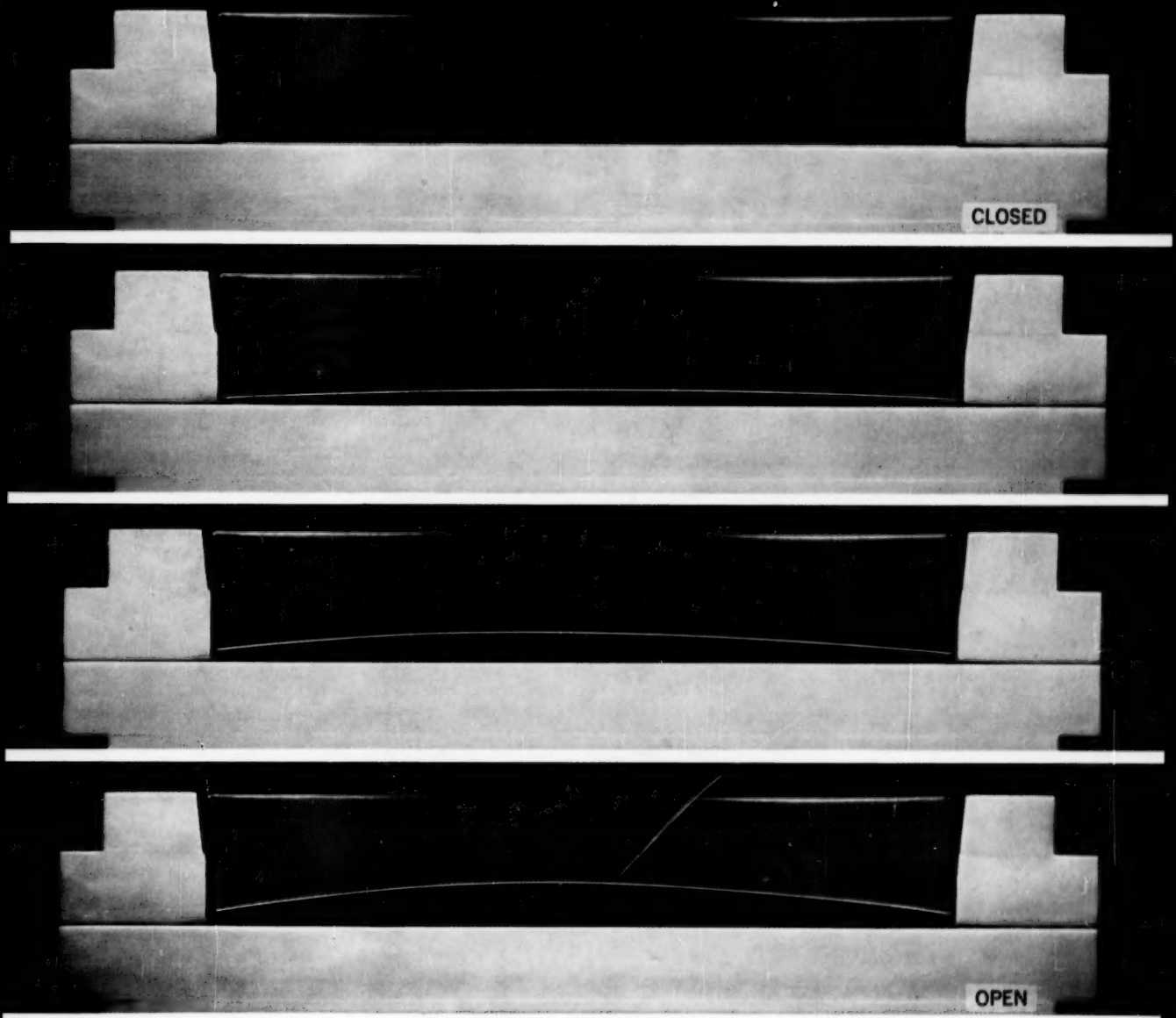
can well serve them all!

Whether it be refractory brick in any or all of the different types and classes . . . bonding mortars . . . monolithic refractories of plastics, ramming mixes and castables . . . acid-proof brick . . . or insulating materials, Harbison-Walker is prepared to furnish all your needs.

Harbison-Walker's expanded manufacturing facilities . . . most modern equipment and techniques . . . widely distributed plants, offices and warehouses contribute to superior service. The advantages of combined shipments of various kinds of refractories and extensive technical application assistance provide additional important benefits that save time and money. Through quality control—from the selection of raw materials to the finished products—continued highest quality is assured.

World's Most Complete Refractories Service

HARBISON-WALKER REFRACTORIES COMPANY
AND SUBSIDIARIES
General Offices: Pittsburgh 22, Pennsylvania



Key to Compressor Reliability . . .

WORLD'S SIMPLEST COMPRESSOR VALVE!



Stainless steel strips, in red, open the Feather Valve ports by rolling contact against the lower plate. There is no impact.

The Feather Valve* is the only compressor valve with no buffer plates or cushioning accessories. The strip is the only moving part and the valve itself is all but indestructible. The fastest-acting on the market, Feather Valves are standard equipment on all Worthington compressors.

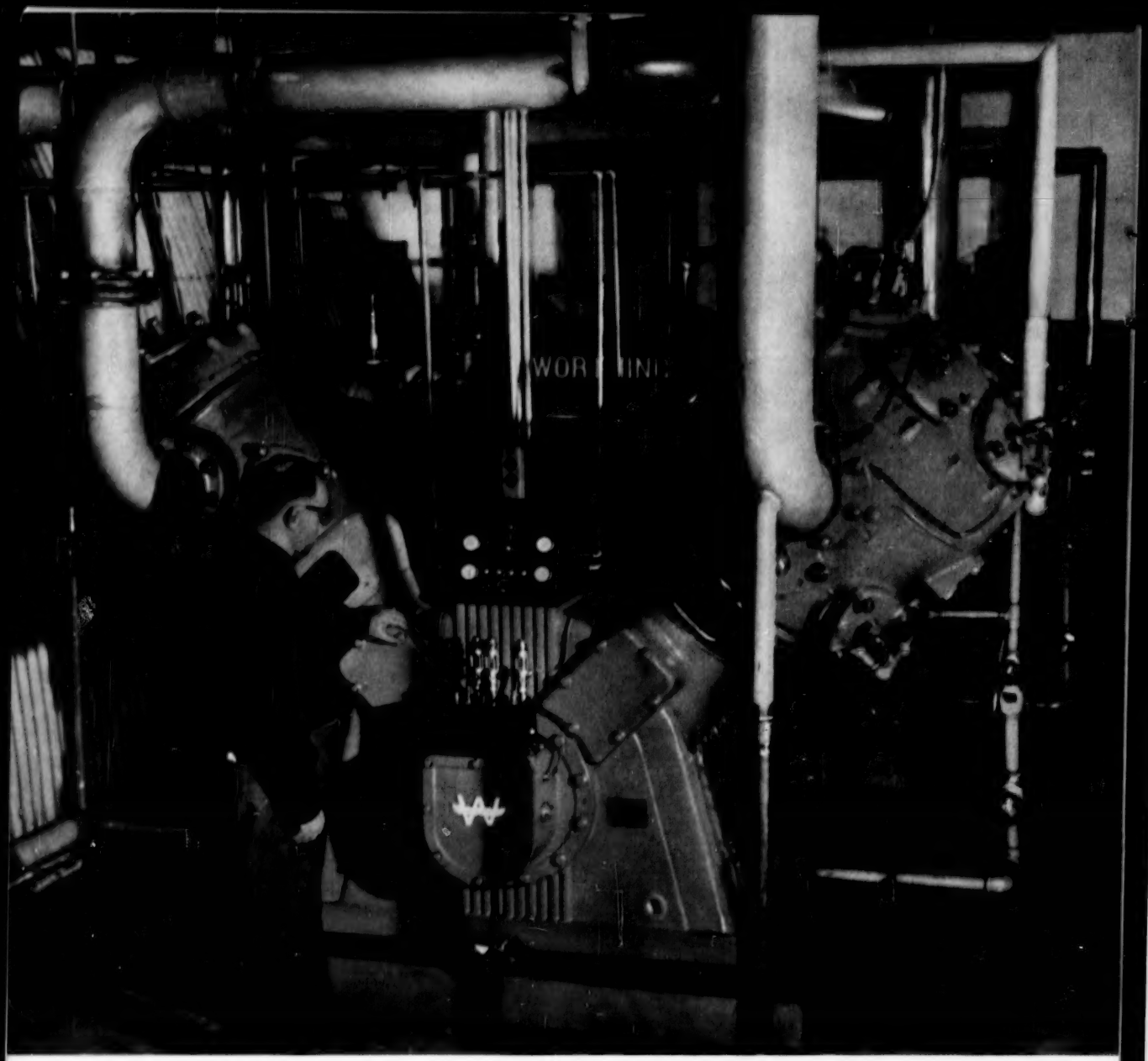
Their extremely fast action means you get virtually no slip or backflow. As a result Worthington compressors give you minimum valve loss and use minimum power.

No Impact. Combined with fast action is Worthington's exclusive "no impact" operation which assures long life and negligible maintenance. The flexible strips open and close with a gentle rolling contact.

For a first hand story of a Feather Valve's ruggedness, see the next page.

WORTHINGTON

*Reg. U. S. Pat. Off.



Feather Valve compressors at Twin Coach plant...

IMPROVE AIR SUPPLY, CUT MAINTENANCE

"This compressor installation cut maintenance costs and improved reliability," reports John Anthony, Twin Coach Company, Aircraft Division plant in Buffalo, New York. "We centralized our compressed air supply with installation of three heavy duty, water-cooled, 2-stage 100 psi Worthington Feather Valve compressors."

Constant-pressure, reliable air supply is the basic Twin Coach manufacturing power service. Regular scheduled preventive maintenance inspections (only four times per year) show that these compressors are giving entirely satisfactory performance.

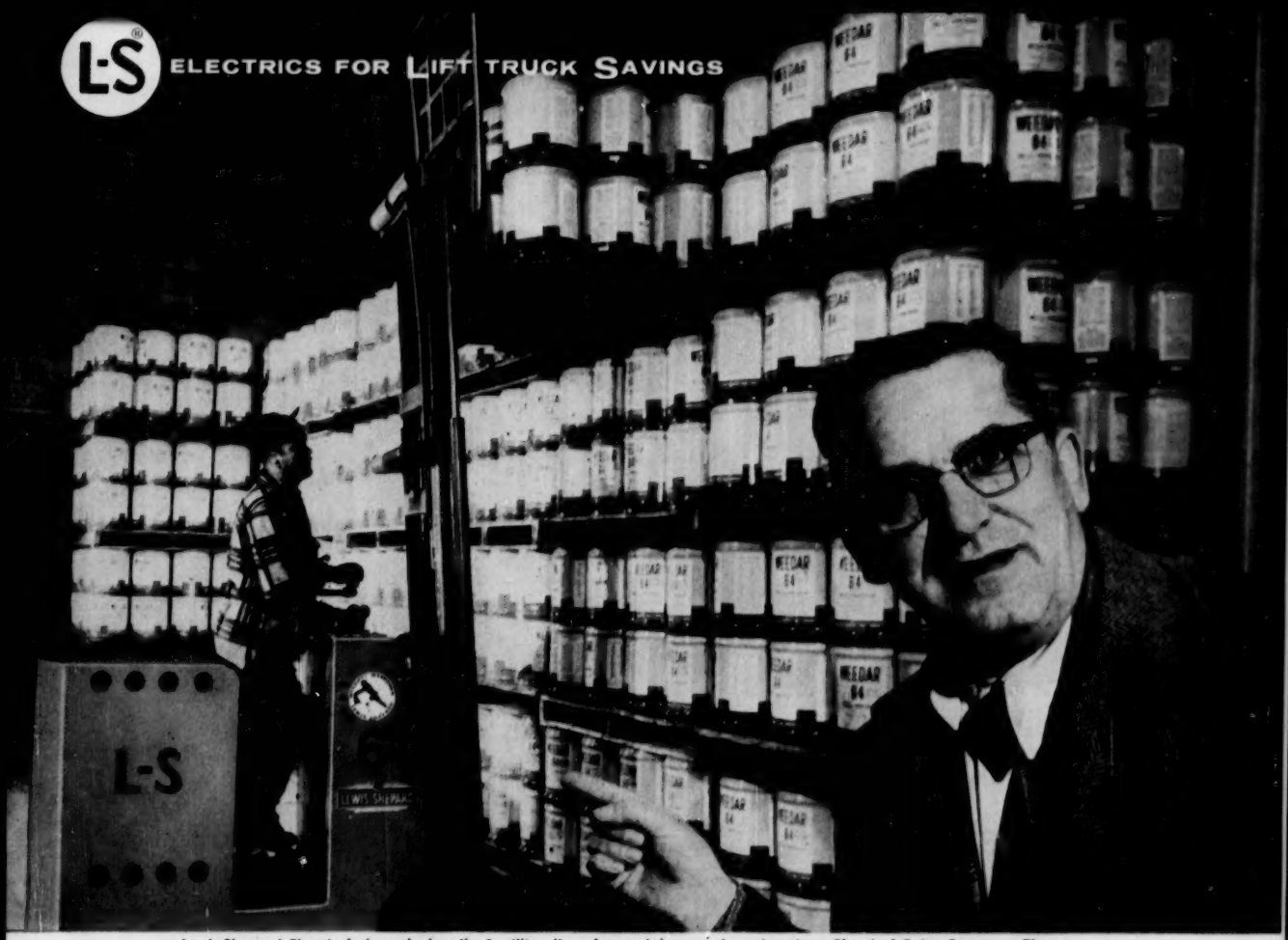
Valves are your key to compressor reliability. Feather Valves, interchangeable between compressor suction and inlet, are the surest acting, tightest, most flexible and fastest made. They are most reliable because they are simplest.

For information regarding your compressed air needs, contact Worthington Corporation, Section K-72, Harrison, New Jersey, stating requirements—or contact your local Worthington representative located in every major city.

WORTHINGTON

See preceding page

L-S® ELECTRICS FOR LIFT TRUCK SAVINGS



Lewis-Shepard Electric fork trucks handle 5 million lbs. of material a month at American Chemical Paint Company. The Model "E" above turns on a 61" radius . . . has timed acceleration and dynamic braking for smooth inching and spotting of loads with unstable stacks. More than 5000 of these 48" pallets are used for uniform handling and storage.

"We practically doubled our storage area—without laying a brick!"

reports Mr. Guy Gochnauer, Supervisor of Materials Handling, American Chemical Paint Co., Ambler, Pa.

Pillars, piping ducts, and a variety of stack sizes are no longer a warehouse problem at American Chemical Paint Company. Planned use of 48" square pallets . . . and a fleet of 7 Lewis-Shepard electric fork trucks . . . now make full use of once-inaccessible areas. Result: floor storage has been nearly doubled without laying a brick!

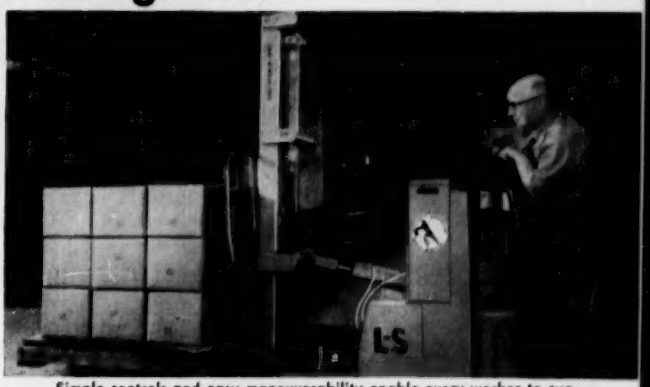
L-S Electrics also provide mobility between departments—work quickly, safely inside semi-trailers at loading docks . . . create no fire or explosion hazards transporting volatile chemicals through refining areas. They cut time and man-power costs in half for inspection and shipping operations.

This versatility is matched by lift truck economy, too. Exclusive L-S "lubricated-for-life" bearings, and no under-truck adjustments, keep maintenance costs down. Year after year . . . Lewis-Shepard Electrics cost far less . . . far outperform and outlast comparable gas-powered trucks.

L-S Electrics can solve your materials handling problem as well. Send for complete facts — mail coupon today.

Here's a list of important companies that have recently reordered L-S Electric Fork Trucks:

Electrical Goods Mfgr.	has	110	in use	reordered 24
Rubber Mfgr.	has	22	in use	reordered 8
Motor Mfgr.	has	50	in use	reordered 18
Overland Express	has	81	in use	reordered 23
Aircraft Mfgr.	has	40	in use	reordered 8



Simple controls and easy maneuverability enable every worker to run this L-S JackStacker "Walkie" Electric. Now, each man finishes his inspection run, moves his load with the JackStacker, and returns without interrupting the inspection line.

L-S **LEWIS-SHEPARD**

The most complete line of materials handling equipment anywhere

The "MASTER" Line

579 Walnut Street, Watertown 72, Mass.

Please send:

☐ L-S Model "E" Catalog #32-1 ☐ L-S JackStacker Catalog #34-1 ☐ L-S Master Line Catalog

Name .....

Company ..... Title .....

Address .....

FACE any Job...



Protection for Face and Hands

HANDLE IT BETTER

With AO Protective Equipment!



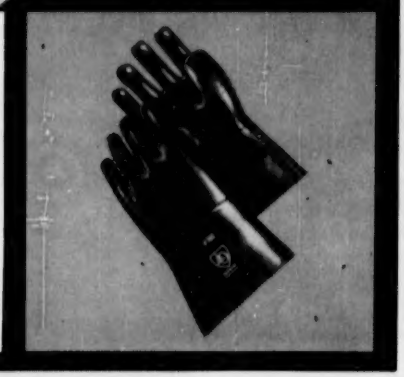
AO H-SERIES FACE SHIELDS

Feature a deep spark deflector which blocks foreign particles from entering at top. Windows set out approx. ¾" for clearance over nose and prescription glasses. An American Optical exclusive is the slotted snap fastener which by allowing for heat expansion, eliminates wear at the holes, and cracking, warping and distortion of windows. Grommet-friction washer combination assures proper friction without adjustment. Headgear is light and very comfortable. Specially treated (antiperspiration), genuine leather sweatbands.

H-5 FACE SHIELD

Attaches quickly, easily. Chemical splashes cannot enter between window and headgear — roll off crown outside of window.





AO PROTECTOCOTE NEOPRENE GLOVES

6 FULLY COATED, quality-controlled gloves in the line to cut your handling costs. Waterproof, dirtproof, oil, grease and solvent resistant. Rugged and durable yet comfortable and flexible with fully curved fingers and thumb. Medium and long lengths. Knit wrist as well as gauntlet types.

AO 780 NEOPRENE COATED GLOVE

Medium length gauntlet which provides hand and wrist protection. 12" overall.

AO PLASTIFAB VINYL PLASTIC GLOVES

6 styles, fully coated or palm coated. Curved fingers ideal for work with wet and dry chemicals, salts, alkalies, oils, greases — they *grip* well! Completely liquid proof. Resists wear amazingly. No seams to irritate. Inexpensive.

AO 13 PLASTIFAB VINYL PLASTIC GLOVE

A popular 14½" long gauntlet. Fully coated. Protects forearms, fingers, palm, wrist.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

Quality costs no more! Always look for AO Trademarked Safety Products. Your nearest AO Safety Products Representative can supply you.

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

GET SPROUT-WALDRON'S *Big Plus*



...in Materials Handling Equipment

PNEU-VAC, shown here, is one of the most modern negative-pressure pneumatic systems available . . . has proved itself in hundreds of installations. It conveys, loads, and unloads granular, pulverized, and flaky materials in tremendous volumes without exterior dusting . . . without intercontamination or infestation of products . . . without handling losses. The unit is self-cleaning and can be made to cool, to heat, to aerate, to dry.

For small and medium size bulk material handling requirements, the Sprout-Waldron pneumatic **Airo-Flow** is available. In addition, Sprout-Waldron offers complete lines of pneumatic bulk trucks, screw and belt conveyors, bucket elevators, and feeders—all with Sprout-Waldron's **BIG PLUS.**

The **BIG PLUS** gives you—at no extra cost—expert engineering guidance on installations and applications . . . plus wide selections of all types of materials handling equipment . . . plus the unique ability to "adaptioneer" equipment to meet your specific needs . . . plus 100% reliability.

Put Sprout-Waldron's **BIG PLUS** to work for you. Let us analyze your materials handling problems and recommend solutions that will cut your costs and save you money. Write for full details.

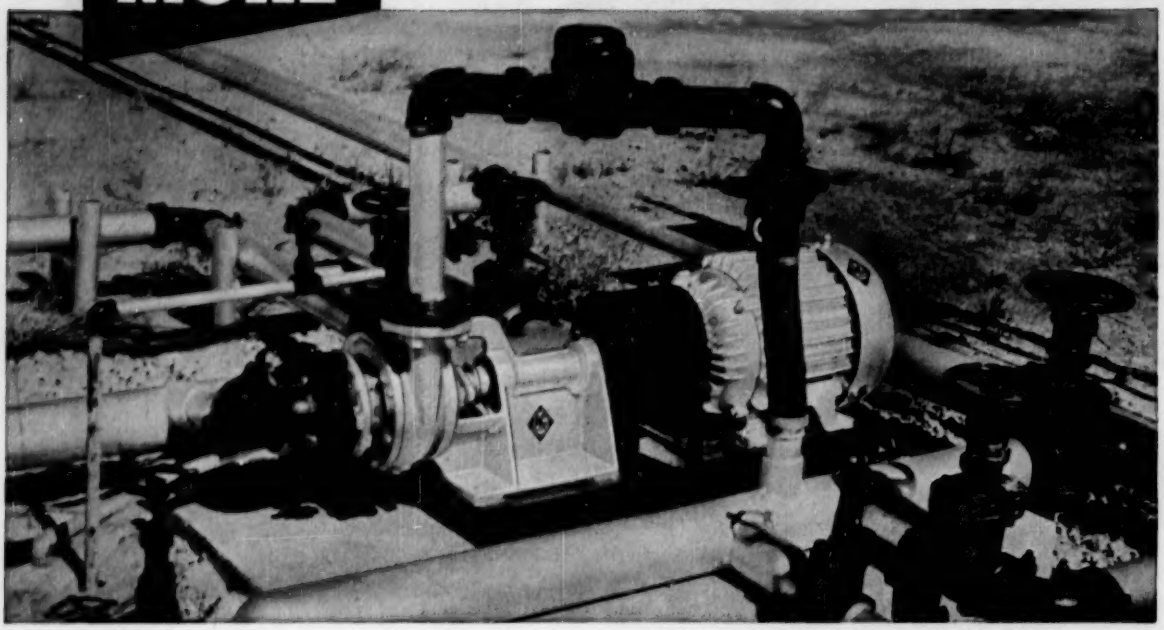
SPROUT-WALDRON

Manufacturing Engineers Since 1866

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PR/A 30

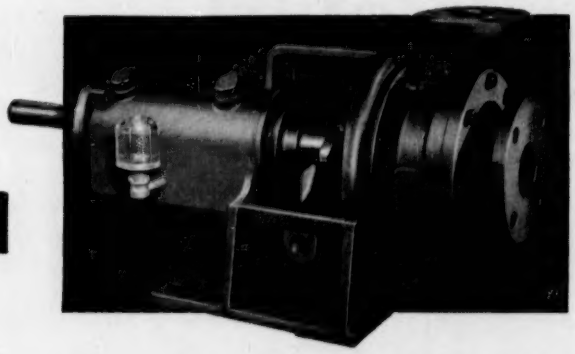
There's MORE pump selection from Allis-Chalmers



Handling corrosive liquids is the job of this A-C pump driven by an Allis-Chalmers 10-hp motor.

You specify the materials in Allis-Chalmers

Frame-Mounted Pumps



Frame-mounted pumps, either grease or oil lubricated, are available with heads to 400 ft, capacities to 3500 gpm, temperatures to 550 F.

Here's a pump that's built exactly right to handle *your* problems of temperature, corrosion and contamination. Reason: *You* specify the materials that go into *your* Allis-Chalmers pump.

Parts are available in almost every material used in pump construction — iron, bronze, stainless steel, high nickel alloys and others. In addition, you pick the sealing arrangement and specify direct coupling or V-belt drive.

Lower cost per gallon pumped results from the custom design of Allis-Chalmers pumps—and they're priced well below "special" chemical and refinery pumps. Next time you need pumping equipment, talk with an A-C pump specialist. Contact your nearest A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

A-5301

ALLIS-CHALMERS

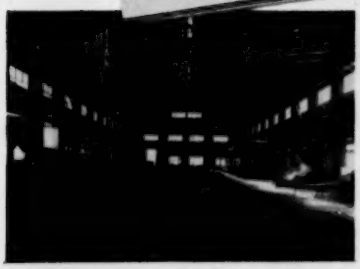
FREE brochure shows NEW PIPE FABRICATING TEAM



THE FLORI PIPE COMPANY and HOUSTON PIPE & STEEL, INC. JOIN FORCES

NEW TEAM ONE OF LARGEST PIPE FABRICATING OPERATIONS IN COUNTRY

Now operating under a single administrative and sales office in St. Louis, the new Flori-Houston team is geared to offer industry a new dimension in pipe fabrication production and service. The addition of the huge Houston Plant to the Flori facilities now offers unlimited production and the combined experience and know-how of all Flori-Houston personnel insures industry a continued high quality product.



INTERIOR VIEW OF HUGE HOUSTON PLANT

...unobstructed production facilities of 560 feet by 106 feet! Visual proof how the new Flori-Houston team can guarantee price . . . delivery . . . quality.

FREE BROCHURE
See the Flori-Houston team in operation.

WHAT THIS MEANS TO INDUSTRY...

1. **PRICE** . . . the new Flori-Houston team is production geared on a quality-volume basis to insure only the best piping at the lowest possible cost.
2. **DELIVERY** . . . the new Flori-Houston team with tremendous multi-plant facilities and service alert policies insures on-time delivery.
3. **QUALITY** . . . new Flori-Houston team combines years of technical experience in all phases of pipe fabricating which insures the same high standards of Flori quality familiar to industry since 1932.

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THE FLORI PIPE COMPANY
601 E. Red Bud Ave., St. Louis 15, Mo.
Gentlemen, please rush free your new brochure "How Piping Is Fabricated," which gives complete information about the new Flori-Houston team.

Name_____

Title or occupation_____

Company_____

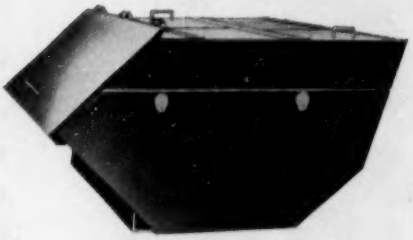
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DISASTROUS FIRES

you can help prevent them by storing and handling materials in fire-resistant LOAD LUGGER CONTAINERS



... another advantage of the modern LOAD LUGGER system

Fire is confined within the steel container, is easy to control and extinguish, often doesn't spread beyond the smoldering stage. The container, fire and all, can be readily moved to a safe area. Consider this Load Lugger advantage when you investigate materials handling equipment. Write today for full information about the Load Lugger system—Load Lugger equipped truck servicing dozens of patented Load Lugger containers. You'll be money ahead.

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EXPORT SALES: BORG-WARNER INTERNATIONAL CORPORATION, CHICAGO





Clearing the way for scoring plays...

. . . is the blocker's job. Without him, the ball carrier is seriously handicapped. The blocker is the "silent partner" of the man who makes the scores.

Industry, too, has "silent partners"—firms like PICCO, who help clear the path to sales success for their customers by providing technical skill and dependable materials used in the formulation of a wide variety of products.

For example, there is **Piccopale Resin,** a petroleum polymer, having wide compatibility with other raw materials used by the compounding industries. Its consistently uniform high quality, and its large, ready availability make **Piccopale Resin** the ideal "silent partner" to use as a starting raw material in creating new products, new markets, and greater profits.

Piccopale Resin engineered to unique physical and chemical properties, is produced in a variety of grades. May we assist you in applying this versatile "silent partner" to your production needs?

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.

Clairton, Pennsylvania

Plants:

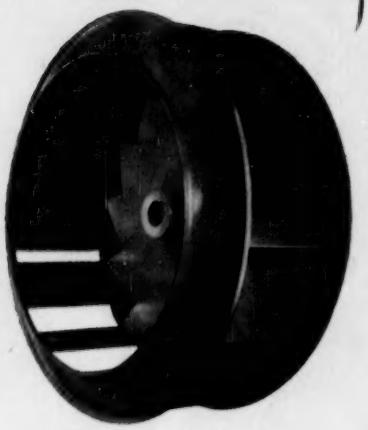
Clairton, Pa.; West Elizabeth, Pa.; and Chester, Pa.

Sales Offices:

Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, Jacksonville, Los Angeles, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco



The Sirocco Wheel—Designed with a multiple number of narrow, curved blades, forward pitched. Operating at low rotative and peripheral speeds, it delivers more air per revolution than any other type of fan.



The HS Wheel—Medium-speed wheel with true non-overloading power characteristic; features large-area die-formed blades, mounted in backwardly inclined position between heavy-duty backplate and streamline rim.

Match the wheel to the job . . . with rugged, quiet American Blower Sirocco and HS Fans!



American Blower fans have Certified Ratings for dependable performance.

American Blower's complete line of fans lets you match the wheel to the duty, whether it's ventilating, air conditioning, heating; or drying, fume-removal, and processing systems. Their heavy-duty design and construction assure you of long fan life with a minimum of maintenance. Take the Sirocco and HS fans, for example:

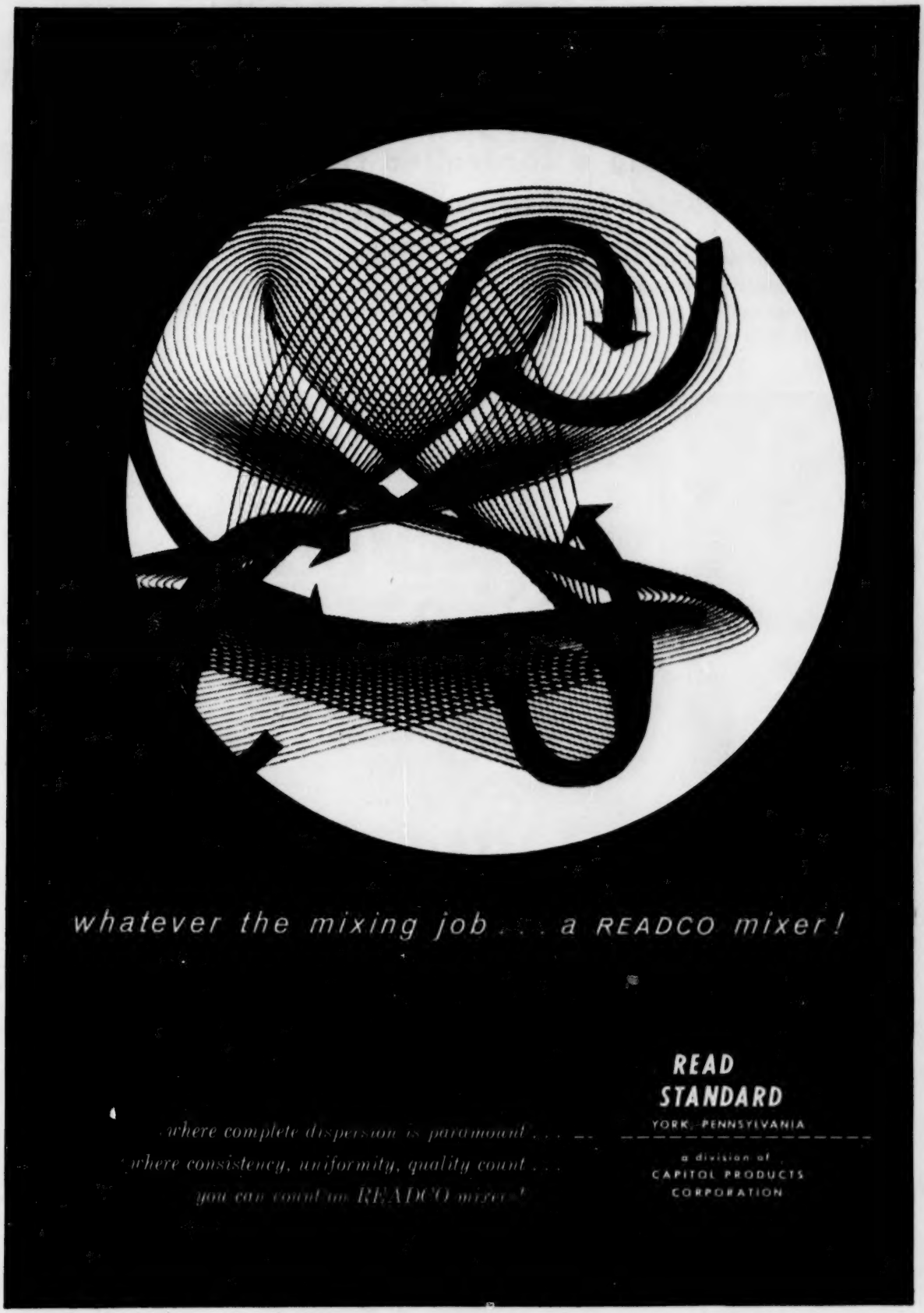
Sirocco and HS fans offer smooth, quiet air delivery, high operating efficiency and dependable service. They are available in 25 standard sizes from 12¼" to 132" wheel diameters for volumes to over 700,000 CFM.

Precision-built Sirocco and HS fans can be specified in single or double inlet and in any of eight standard discharges, with ball, roller or sleeve bearings as required. Inlet vanes, dampers or Gýrol Fluid Drive can be furnished to meet volume control requirements. Larger sizes are designed so that they can be dismantled for easy handling in shipment, erection and maintenance.

Get details on the complete line of American Blower fans. Call our nearest branch office; or write direct to American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

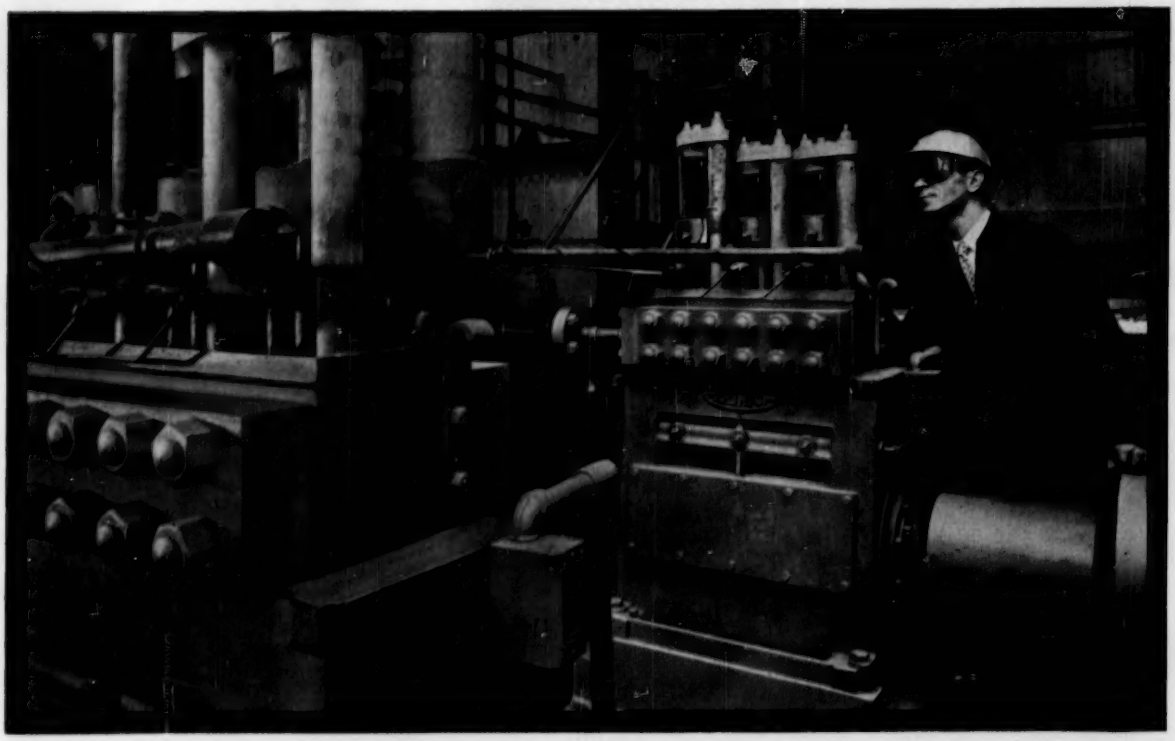
Division of **AMERICAN-Standard**


whatever the mixing job . . . a READCO mixer!
. . . where complete dispersion is paramount . . .
. . . where consistency, uniformity, quality count . . .
you can count on READCO mixers!
READ
STANDARD
YORK, PENNSYLVANIA
a division of
CAPITOL PRODUCTS
CORPORATION

SPENCER CHEMICAL CO. UNRAVELS KNOTTY PROBLEM:

Maintaining a controlled flow of liquid ammonia at high pressures, 24 hours a day.

At the Vicksburg, Miss. plant of Spencer Chemical Company, ammonia production demands two things of pumps: (1) 24-hour, 7-day-week operation and (2) continuous flow of controlled volumes of liquid ammonia at high pressure.



How Spencer licked the problem: When Spencer began outlining construction plans in 1951, company engineers specified two Aldrich Direct Flow, ¾" x 3" stroke Triplex Pumps. These were scheduled to be used for alternate 30-day periods. According to company spokesmen, nearly four years of service have proved these pumps to be efficient and capable of durable service.

Results: Dependability and freedom from trouble in all phases of operation. The Vicksburg Works Maintenance Superintendent tells us: "The Aldrich Pump is an excellent unit. Valve life is excellent and packing life exceptionally good."

We'll be glad to send you full information on Aldrich Pumps and their advantages to you. Simply write Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

How to evaluate materials of construction for the chemical plant

Choosing materials of construction for chemical-industry equipment is a complex job. The first step toward the solution of a new problem is the analysis of all the requirements that can be anticipated. If they indicate one or more of the properties shown, chances are that Crucible *stainless* steel is the most practical choice you can make.



RESISTS CORROSION – Stainless is almost impervious to attack by oxidizing acids like nitric acid. It resists strong alkaline solutions, and many other chemical compounds.

PREVENTS CONTAMINATION – With stainless there's no pickup of metallic ions or deterioration in the product. Stainless stays out of the process solution.





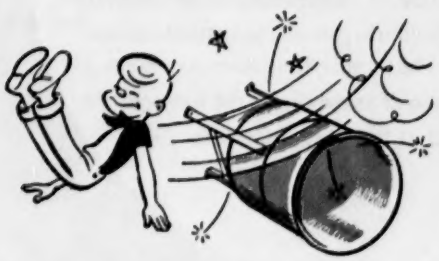
CLEANS EASILY—Even for the most rigorous cleaning problem—that of decontamination to remove radioactive matter—stainless is chosen decisively over other materials.



WITHSTANDS TEMPERATURE EXTREMES – At very high temperatures, stainless stays strong. At very low ones, it does not become brittle as other metals may.



PROVIDES GREAT STRUCTURAL STRENGTH –Stainless is about 50% stronger than mild steel. It permits lightweight, durable construction of chemical processing equipment.



RESISTS WEAR AND ABRASION – Erosive and abrading action makes the surface of stainless harder. It's ideal for mixers, chutes, bins and piping.



ALLOWS COMPLEX FABRICATION—Stainless can be cut, bent, drawn, welded, machined, forged, spun, riveted, cast—fabricated by all the common metal-working processes. Stainless imposes no restrictions on equipment design.

Crucible metallurgists have had considerable experience with stainless in chemical applications. They will be happy to work with you to make the best, most economical use of stainless in your plant. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

Send for a copy of the 44-page booklet "Making the Most of Stainless Steels in the Chemical Process Industries". It's packed with data you can use.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

you can judge

the comparative values of furnaces [illegible]

[illegible] applied to [illegible]

It's quite simple

Here are

9

to obtain the full comparison of values



Whenever all these 9 specifications are applied to all the operating requirements, you can be sure PETROCHEM ISOFLOW FURNACES will be found most economically desirable.

No other furnace design can claim the recognition and acceptance achieved by PETROCHEM ISOFLOW FURNACES . . . starting with one installation in 1940, January '57 records more than 1650 ISOFLOW FURNACES in operation and under construction—a record that is incomparable just as all Petrochem Isoflow furnaces are more economically desirable by any comparison.

1—Average radiant transfer rate. **2**—Maximum deviation from average radiant transfer rate. **3**—Average and maximum transfer rate in convection section. **4**—Maximum tube wall temperature, radiant or convection. **5**—Maximum efficiency with specified excess air. **6**—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube. **7**—Overload and corresponding transfer load. **8**—Design to provide: structural column supports · Ladders · Platforms · Tube Removal facilities, etc. **9**—Degree of assembly; of the furnace structure and of the heating surface.

PETROCHEM-ISOFLOW FURNACES

[illegible]

REPRESENTATIVES:

[illegible]

Sam Spinner's Mail Box



by Sam Spinner

Dear Sam: We want to remove objectionable particles too small to screen out but large enough to clog a filter quickly. Can you help? (Chemical Company)

Solution: An AT&M Imperforate Basket Centrifugal separated particles and proved easy to clean. The basket was cleaned out by a positive speed unloading drive and plow.

Dear Sam: A noxious slurry containing 20% solids and a small amount of objectionable salts requires separating the mother liquor and removing the salts from the solids.

Solution: Not too complex. An AT&M Perforate Basket Centrifugal spun off the mother liquor, washed away the objectionable salts and spun the solids to the required dryness in an automatically timed cycle.

The objectionable fumes were controlled by a fume type cover. The solids were then easily plowed out by an AT&M unloading drive and discharger.

Send questions to Sam Spinner. If there isn't an answer he'll know. If there is one you'll get it right away.



AT&M Mobile Unit permits centrifugal tests in your laboratory with the materials you use in processing — under your actual working conditions.

Laboratory on Wheels solves problems on the spot

Here's help for any chemical processing plant with a separating problem.

AT&M now sets up a laboratory in your plant. Here it can be certain that the conditions and materials will be identical to those of the actual processing. It can be determined on the spot whether an AT&M centrifugal can solve the problem.

AT&M centrifugals are widely used in Separation, Dehydration, Coating, Filtering, Impregnation and Sedimentation processes.

New models make maximum use of time and space, with top safety. Send coupon for data.



AMERICAN TOOL & MACHINE COMPANY
1415 Hyde Park Ave., Boston 36, Mass.

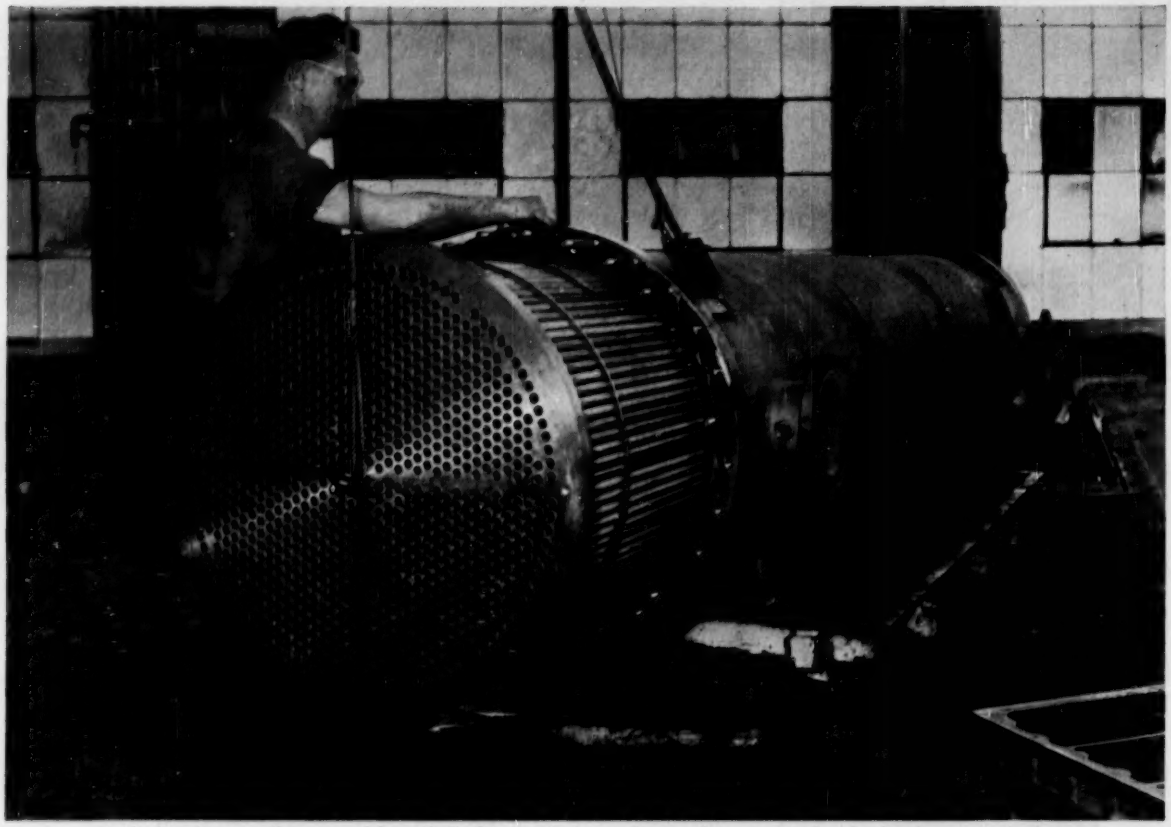
Please send me my free copy of the new AT&M booklet "Centrifugal Force." I am interested in the following processes:

Separation ☐ Extraction ☐ Dehydration ☐ Clarification ☐
Coating ☐ Filtration ☐ Draining ☐ Thickening ☐ Impregnation ☐
Sedimentation ☐

SAVE TIME, SPACE AND COSTS WITH

A.T. and M.
CENTRIFUGING

Name.....Title.....
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Street.....
City.....Zone....State.....



Tube bundle partially removed from shell of General Electric heat exchanger. Fixed-end tube sheet is Ambraloy-917, one of The American Brass Company's aluminum-bronze alloys. Tube sheet is 36⅝" diameter, 2" thick.

Thick, rolled circles of Anaconda Aluminum Bronze available for high-strength tube sheets

Where superior strength and corrosion resistance are required in heat-exchange applications, the use of *rolled* circles of Ambraloy-917 for the tube sheets offers appreciable savings in material cost compared to circles produced by the forging process. The American Brass Company can furnish Ambraloy-917 in rolled circles up to 5" thick, maximum diameters are governed by thickness.

Anaconda sheets, plates and circles are available in a wide range of alloys and sizes for heat-exchange service in marine and stationary-steam power plants, oil refineries and other process industries. Produced by the rolling process, they are commercially flat, accurate in dimensions and are free from the surface imperfections and porosity often prevalent in cast plates. The American Brass Company makes plates for condenser tube sheets of copper and several copper alloys in rectangular sizes up to 156 inches in width and weights up to 15,000 pounds for any shape that can be cut from such sheet. The maximum standard limits for circles are 160 inches in diameter and 11,000 pounds in weight. Half-circles can be produced up to 13,000 pounds in weight.

Special jobs. When specifications call for extremely large plates for special applications, The American Brass Company will gladly cooperate in the solution of such problems. For further information on Anaconda Condenser Tubes or Tube Sheets write: The American Brass Company, Waterbury 20, Conn. 8795



Completed General Electric water-to-water heat exchanger for cooling the condensate recirculated through the hydrogen coolers of a 427,500-kva cross-compound turbine-generator unit. Water box cover is also Ambraloy-917, 36½" diameter and 2⅝" thick.

ANACONDA®

TUBES AND PLATES FOR CONDENSERS AND HEAT EXCHANGERS

Made by

The American Brass Company

THIS COMPLETE LINE MEETS EVERY NEED FOR PUSHBUTTONS





STANDARD DUTY



HEAVY DUTY

Name your pushbutton requirement—there's a Square D unit to do the job, exactly. Three complete lines . . . standard duty, heavy duty, and oil-tight heavy duty . . . each providing a wide range of operators, stations, and circuit combinations.

Write for Pushbutton Bulletins which give complete details. Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.



OIL-TIGHT HEAVY DUTY

Available in 1 to 16 unit sizes. 6-9-12-16 unit stations have hinged covers for easier wiring

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

IT STICKS TO HOT OR COLD SURFACES!

EAGLE-PICHER

SUPER "66"

INSULATING CEMENT



SPOTTING! TROWELLING! FINISHING!

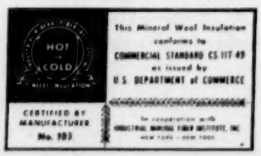
- Because it sticks, Super "66" saves time—applies quickly to any equipment, cold or hot! Effective up to 1800 F.
- Because it sticks, Super "66" saves money—provides far greater coverage and more efficient insulation.
- Because it sticks, Super "66" makes difficult jobs easy—can be used on irregular shapes where application of other insulations is often impossible. Usually requires no reinforcing on applications up to 1½ inches thick.
- Unique "springy ball" structure of small, resilient mineral wool pellets results in maximum efficiency—maximum fuel savings!
- Super "66" contains a special rust inhibitive which actually prevents corrosion!

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

FREE SAMPLE!

Write today!

Eagle-Picher Super "66" Insulating Cement conforms to Commercial Standard CS-117-49.



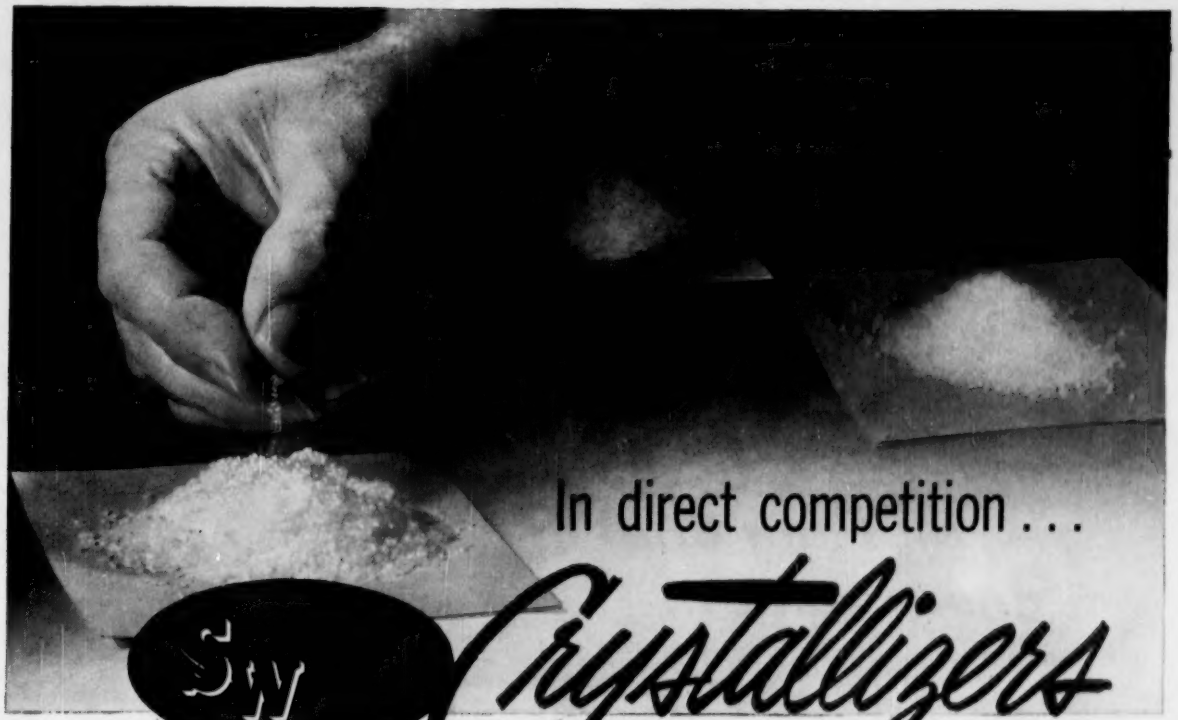
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EAGLE PICHER

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S-W Crystallizers

LEAD in product quality in operating economy

1. BETTER DEWATERING ON CENTRIFUGE OR FILTER
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Why do users who know prefer S-W Krystal® Crystallizers? The answer is uniformly sized, dust-free crystals, product purity, ease of centrifuging or drying, high recovery of mother liquor, effective operating economy and less downtime for cleaning.

If you make a crystalline product you owe it to yourself to investigate these advantages before you invest. Struthers Wells will gladly conduct a pilot study to assure you of the finest crystalline product at the lowest practical cost.

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MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

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® Krystal Registered U. S. Patent Office

STRUTHERS WELLS *Corporation*

WARREN, PA.

Plants at Warren, Pa. and Titusville, Pa.

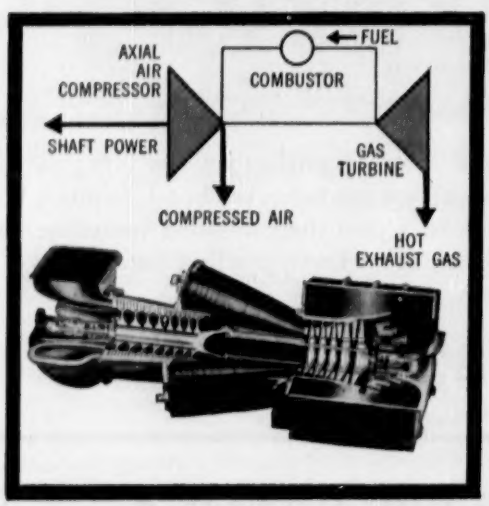
Offices in Principal Cities

3 FROM 1

Shaft power, compressed air, heat... all from one gas turbine...

BY TAKING ADVANTAGE of the versatile Westinghouse gas turbine, engineers are simplifying many processes. For example . . .

As gasifiers—In a large Southwestern butadiene plant, four Westinghouse gas turbines will soon be operating as gasifiers for the reactivation of the catalyst and each will eliminate the need for a separate prime mover and a separate air compressor.



In addition, smaller line heaters and less fuel will be used because *all* the *Btu's* put into the gas turbine are exhausted to the heaters and process, with the exception of minor radiation and bearing losses.

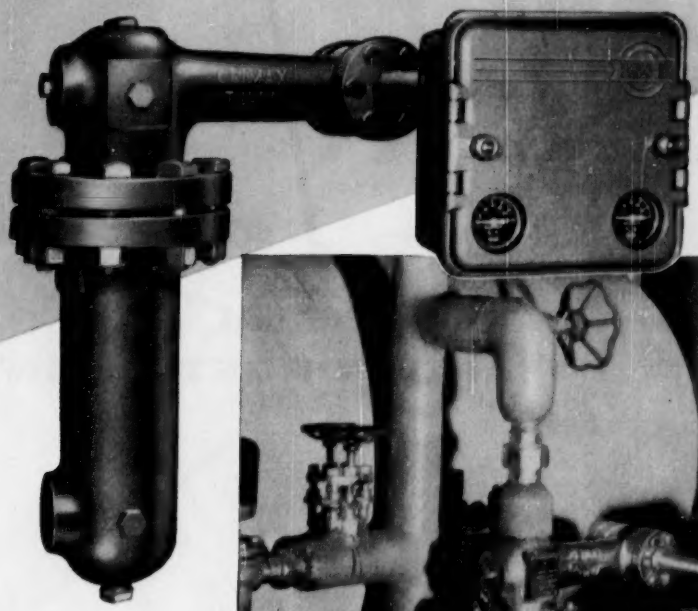
Versatility—The modern Westinghouse gas turbine can be used to streamline processes, for it offers many combinations of output:

Shaft power.....up to 22,500 hp
Compressed air.....up to 85 psia
Hot gas (18% oxygen).....up to 1000°F

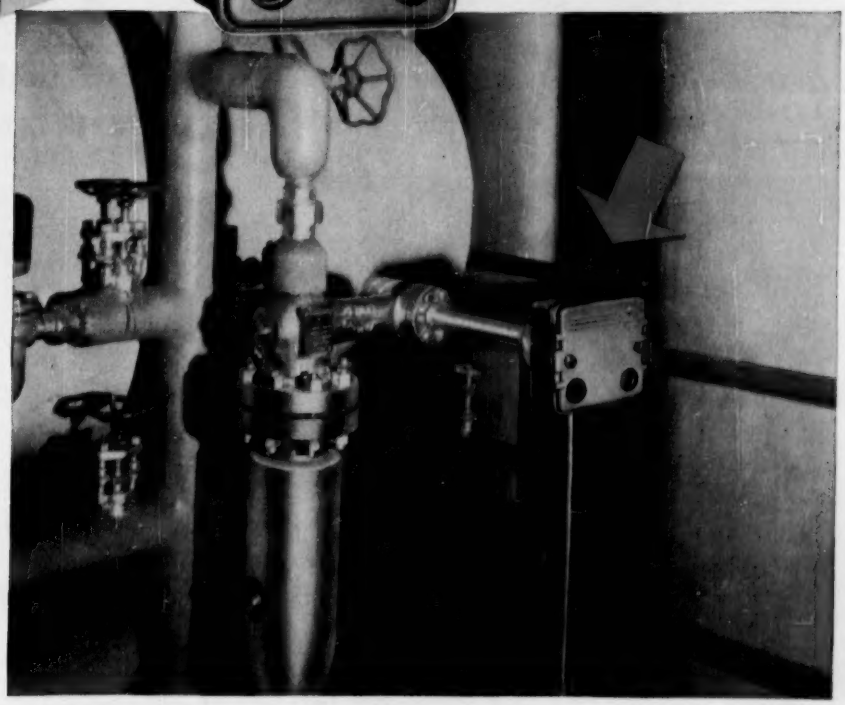
Ask today for your set of suggested process sketches. Contact your Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50598

YOU CAN BE SURE...IF IT'S Westinghouse

When An External Cage Type Liquid Level Controller Is Indicated, Specify The . . .



BS&B Type 71-06, Series 2!



OVER 60 YEARS — BS&B — RELIABILITY

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

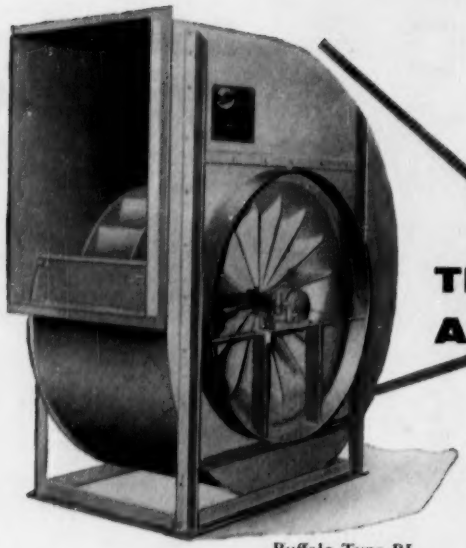
1. **"Built In" Accuracy:** Engineered to control within close level tolerances.
2. **Rugged:** Capable of continuous operation under severe service conditions.
3. **Versatile:** May be either transmitter or controller. Set for differential-gap, on-off, or proportional control. Controller output range in 3-15, 3-27 and 6-30 psig.
4. **Time Proven:** Utilized on heat exchangers, reboilers, deaerators, condenser hotwells and other similar applications in plants the world over.

For Complete Information On The BS&B Type 71-06, Series 2, Or Other BS&B Liquid Level Controllers, Contact Your BS&B Sales Engineer — or Write To . . .

BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-N9

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Buffalo Type BL
Limit-Load® Fan

THE "INSTALL-IT AND-FORGET-IT-FAN"

FOR INDUSTRIAL AIR-MOVING

With the "Buffalo" Type "BL" Fan, you're assured of dependable, economical, long lasting air-moving service for **your** particular air conditioning, ventilating or other industrial application. Here's why:

LONG, TROUBLE-FREE LIFE: because "Buffalo" gives you heavy gauge construction, rigid bracing, oversize self-aligning bearings, and a wheel which is die stamped, riveted and welded.

FULL RATED DELIVERY ON THE JOB: is insured by the proven backward-curved blade wheel, die-formed fixed inlet vanes, and wheel-suited housing.

QUIET OPERATION: made possible by complete streamlining from inlet to outlet plus precision balance of the wheel.

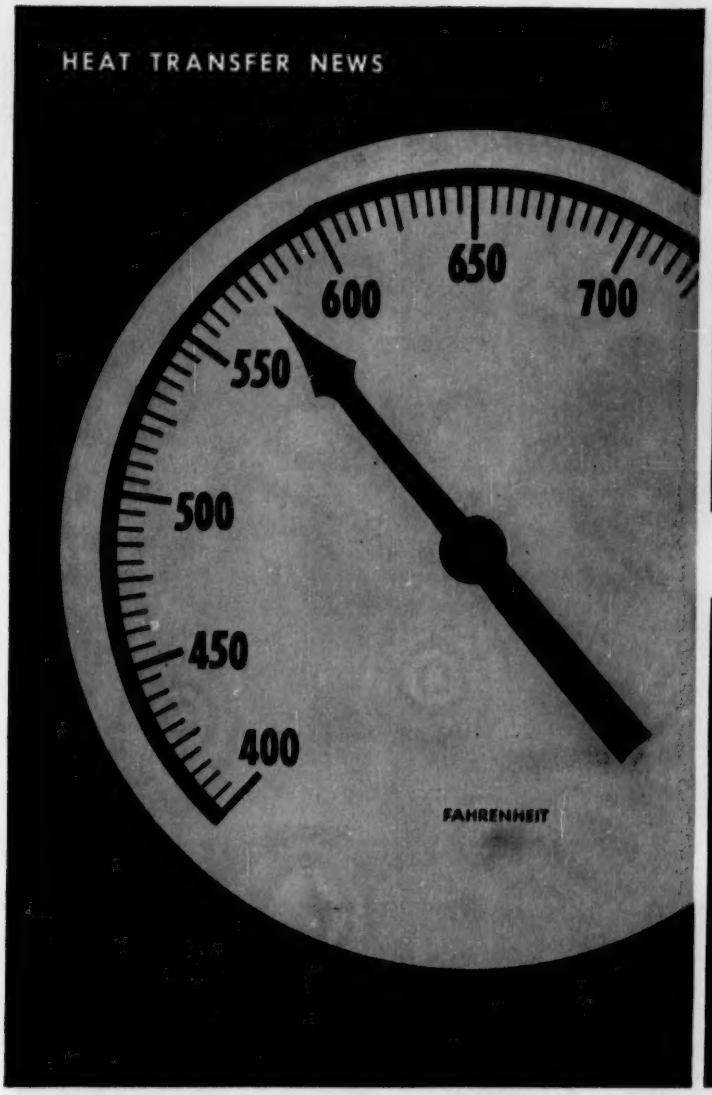
EASY INSTALLATION: on sturdy base, due to ample inlet and outlet collars. Larger sizes have split housings for convenient handling during installations.

Every "Buffalo" Fan is test-run before it leaves our shop. This assures you of peak efficiency . . . smooth, quiet operation . . . and a long life of completely reliable service. Want Full Details on "Buffalo" Type "BL" Fans? Just write us, now, for Bulletin F-102.

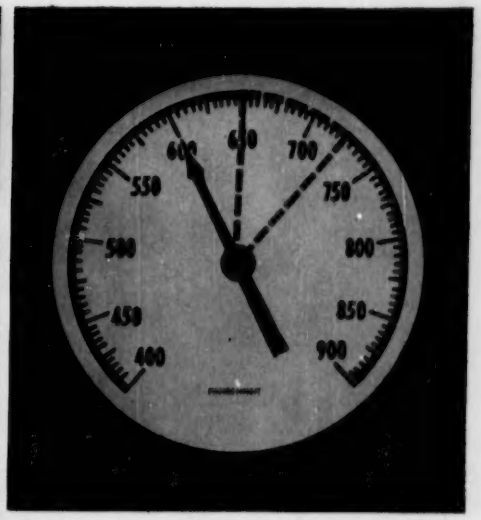
. . . that is, forget your "Buffalo" Type "BL" Fan as far as any day-to-day attention is concerned. It'll do its superb job, month-after-month, year-after-year, with no servicing other than routine maintenance. You can rely on the famous "Buffalo" "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY
BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

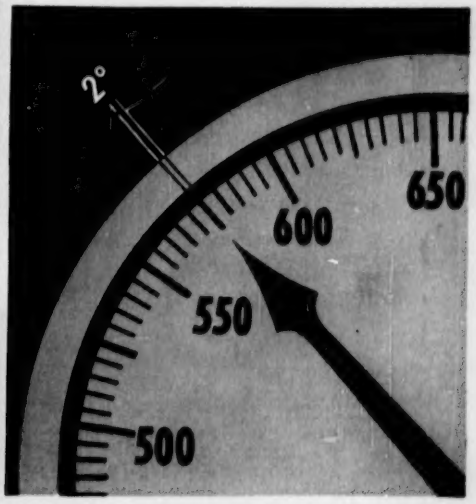
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING



Continuous operating temperature up to 600° F.



Boiling range 652° to 725° F.—assures liquid at all times.



Pin-point control within 2° F.

Write Monsanto for sources of heating systems using Aroclor 1248... a non-pressurized, liquid-phase, heat-transfer fluid

Aroclor 1248 is a new kind of heat-transfer fluid that's fire-resistant and operates at atmospheric pressure.

The Equipment... Capacities can range from small portable units, usually electrically heated, to large gas- or oil-fired units generating from 250,000 to over 10,000,000 B.T.U.'s per hour. Circuits are closed, forced circulation. Compact design saves space, minimizes installation and maintenance costs.

The Fluid... Aroclor 1248 is a highly stable chlorinated polyphenyl; does not support combustion up to its boiling range 652° to 725° F.; has autogenous ignition temperature of extremely high 1299° F.; is non-corrosive. Aroclor 1248 operates in most systems four to seven years without replacement.

Monsanto will send you a list of designers and manufacturers of Aroclor 1248 equipment. Write today.

AROCLOR: Reg. U. S. Pat. Off.

Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Dept. IF-72, St. Louis 1, Missouri

MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

Automation has raised productivity to new high levels

JEFFREY
Spiral Conveyors are important in moving materials

THE HIGH DEGREE of automation has raised productivity per man to new high levels in many plants throughout industry. Transfer of materials is largely under automatic control, for example, as evidenced by these Jeffrey spiral conveyor systems.

Jeffrey spiral conveyors offer an economical means of handling dry, loose bulk materials. Compact, they occupy a minimum of space. Convenient, they can be fed or discharged at any point along their length. Jeffrey makes them in open and dust-tight styles, of metals to suit particular requirements.

Jeffrey engineers will assist in selecting conveyors to meet your handling needs. Catalog 851 describes spiral conveyors. The Jeffrey Manufacturing Company, 909 North Fourth Street, Columbus 16, Ohio.



Paper stock in a paper mill is automatically moved from one operation to another by spiral conveyors.

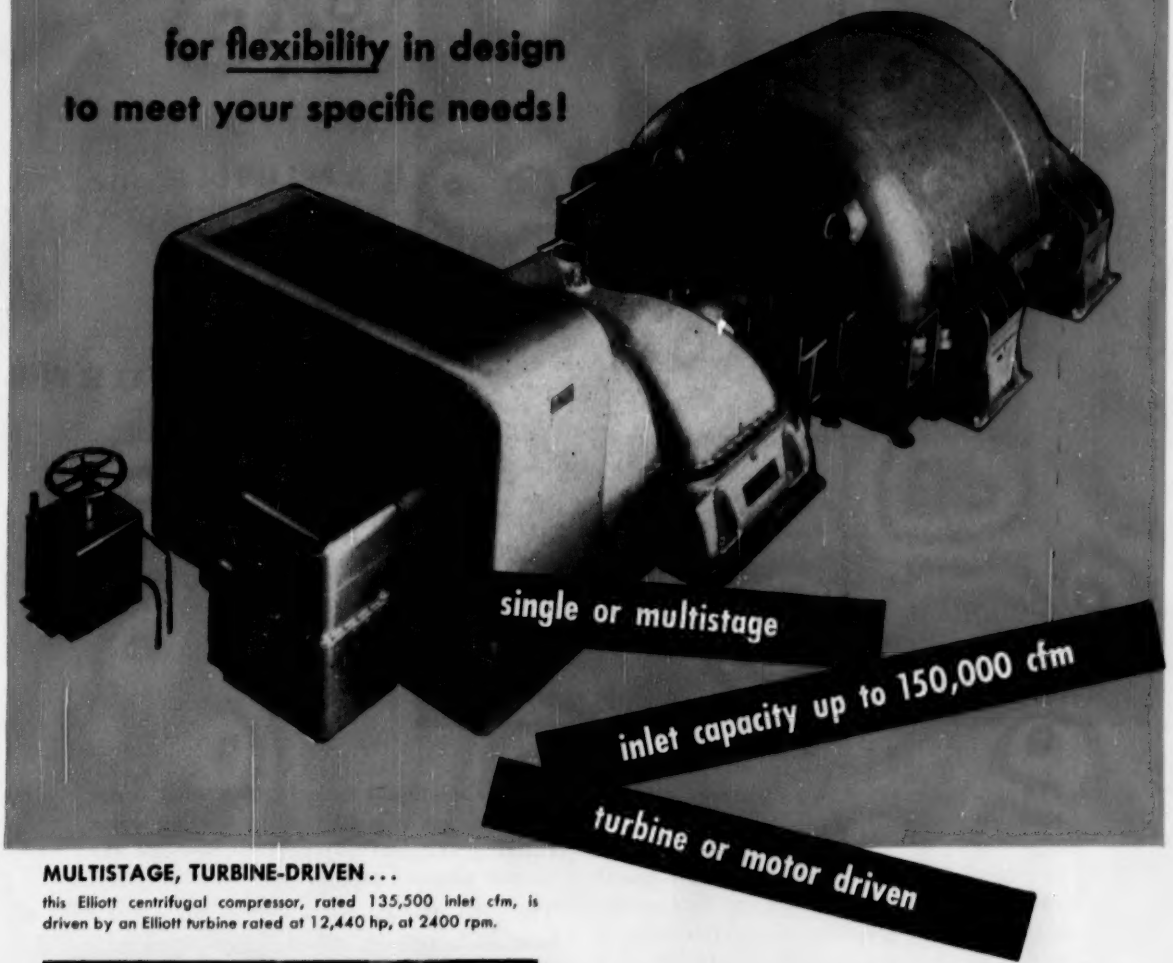


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JEFFREY

ELLIOTT Centrifugal Compressors . . .

for flexibility in design to meet your specific needs!



MULTISTAGE, TURBINE-DRIVEN . . .

this Elliott centrifugal compressor, rated 135,500 inlet cfm, is driven by an Elliott turbine rated at 12,440 hp, at 2400 rpm.



SINGLE-STAGE, MOTOR-DRIVEN . . .

this Elliott centrifugal compressor, rated 18,000 inlet cfm, is driven by an Elliott 450-hp splash-proof induction motor at 3550 rpm.

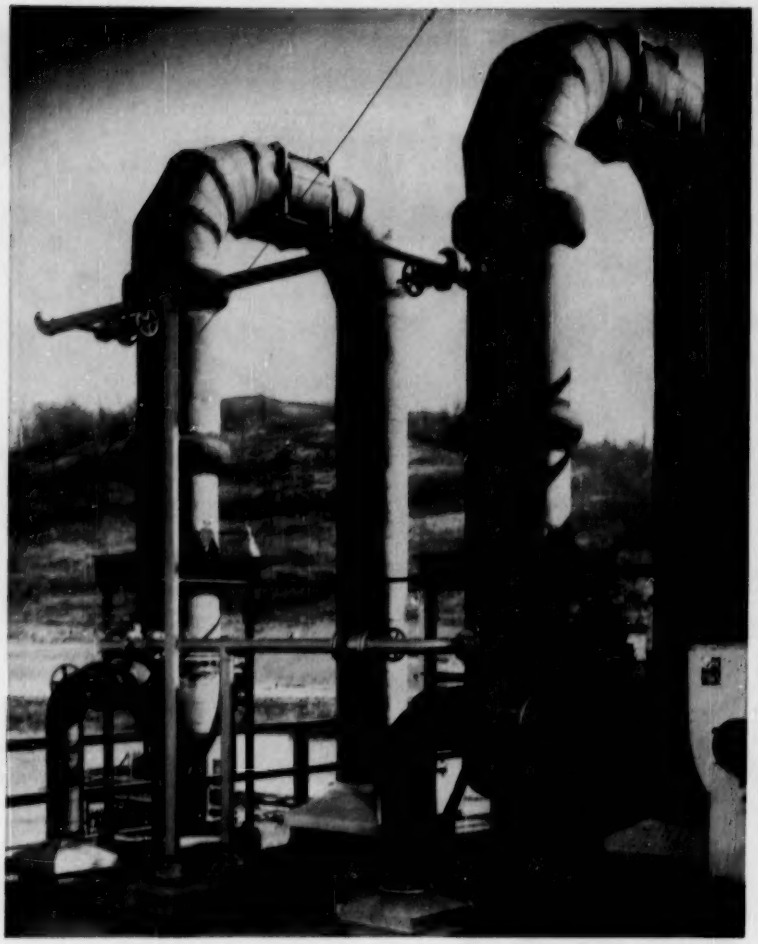
For nearly fifty years, Elliott has been building centrifugal compressors for all applications. The standardized conservative design of Elliott compressors results in dependable service and low maintenance.

Manufacturing both turbines and motors which drive the compressors, Elliott is able to match drives to specific compressor requirements both in physical design and in performance.

Call your nearby Elliott District Office for detailed information, or write Elliott Company, Compressor Department, Jeannette, Pa.

97-4

ELLIOTT Company



ON DUTY FOR NATIONAL ANILINE...

NICKEL HEAT EXCHANGERS FROM

ALBERGER

The new Moundsville, West Virginia, plant of National Aniline Division, Allied Chemical & Dye Corp., has some of the most modern chemical processing equipment to be found anywhere in the world. Among this equipment are many Alberger Heat Exchangers, of which two are shown above as the left part of each inverted U.

The two heat exchangers are identical. Tubes, tube sheets and end sections are of nickel to handle the end product of the plant—diisocyanates. Shells with expansion joints are of carbon steel.

The final product enters the heat exchangers at the top as a gas and flows out of the exchanger as a liquid through the elbows at the left. The gas is condensed by cooling water entering and leaving the shell through the narrow silvered piping.

The axial thermal expansion of piping and heat exchangers is absorbed by nickel anti-compression expansion joints shown at the top of each inverted U. These joints were engineered and manufactured by American District Steam, which, like Alberger, is also a division of Yuba Industries, Inc.

Alberger has made 40,000 installations since its founding 53 years ago. Its engineers would be pleased to consult with you regarding heat exchangers.

ON THE WEST COAST
CALIFORNIA STEEL PRODUCTS DIVISION
Richmond, California

ADSCO DIVISION
YUBA INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

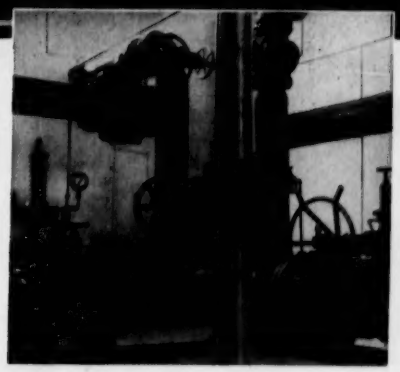
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MOLTEN SODIUM
ANTI-FREEZE







QCf LUBRICATED PLUG VALVES are successfully meeting the requirements of all of these chemical services. Their cylindrical plug with round or rectangular port is non-wedging, non-sticking . . . has the same area opening as the pipe. Their quarter-turn, quick opening and closing assures positive, precise flow control.

QCf Valve Lubricants are specifically compounded for the commodity handled. Years of research and experience have proved the importance and value of the right lubricant for the right valve service.

If you are handling these or other chemicals, **QCf** Valves and **QCf** Valve Lubricants may be the answer to your valve requirements. Ask your W-K-M representative for specific information on your valve requirements.

5614

W-K-M

DIVISION OF QCf INDUSTRIES INCORPORATED

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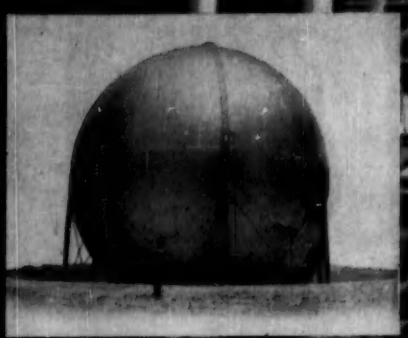
W-K-M THROUGH-CONDUIT GATE VALVES	QCf LUBRICATED PLUG VALVES	KEY RETURN BENDS AND FITTINGS

PLATE FABRICATION AND ERECTION

of vessels, tanks, towers, odd and intricately designed chemical equipment...to any size...of any material: steel, aluminum, stainless, stainless-clad, special alloy, etc.

HAMMOND IRON WORKS has a background of more than 50 years' successful service to the chemical industry. With its 5 plants and its know-how, based upon experience, no job is too large or too small for Hammond.

Catalog 54B illustrates the Hammond story . . . write for your copy.

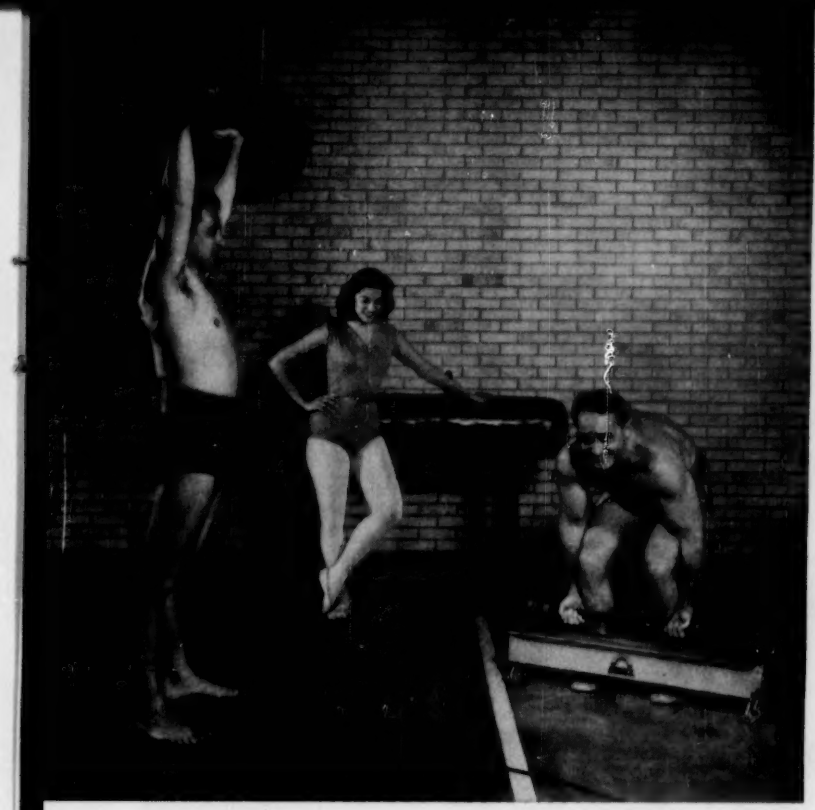


HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH
CASPER, WYOMING • BIRMINGHAM, ALABAMA

Sales offices throughout the U. S. A.; licensees and sales offices in many foreign countries including Argentina, Belgium, Brazil, Canada, Columbia, Egypt, England, France, Haiti, Italy, Japan, Mexico, Netherlands, Peru and West Germany.

HAMMONDTANK



MAGNET MOCKS MIGHTY MUSCLE-MAN! This rugged weight lifter is certainly no "97 lb. weakling" but no matter how he grunts and groans he'll never be able to lift this weight. It's held in place by a HI-POWR Alnico V magnet bolted to the floor. (The weight was finally broken from the magnet's attraction by two strong men using hard-wood pry-bars). This idea of herculean power has found a practical application in industrial processing lines, where magnetic separators are used to remove dangerous tramp iron before it causes machinery damage, fires or product contamination. *All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments. Their magnetic power lasts a lifetime. The first cost is the only cost.*

MAGNETIC IDEAS FROM ERIEZ

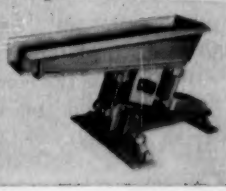
ERIEZ HI-POWR MAGNETIC SEPARATORS

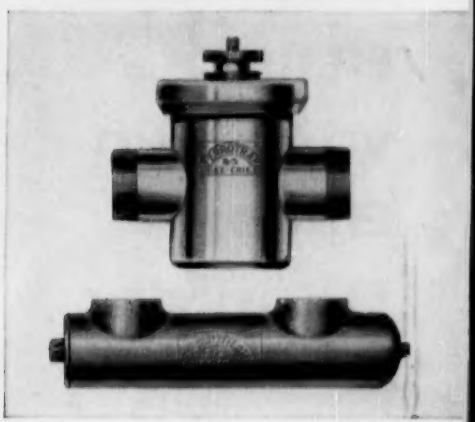
ERIEZ HI-VI VIBRATORY EQUIPMENT

New! HI-VI electro-permanent magnetic vibratory equipment

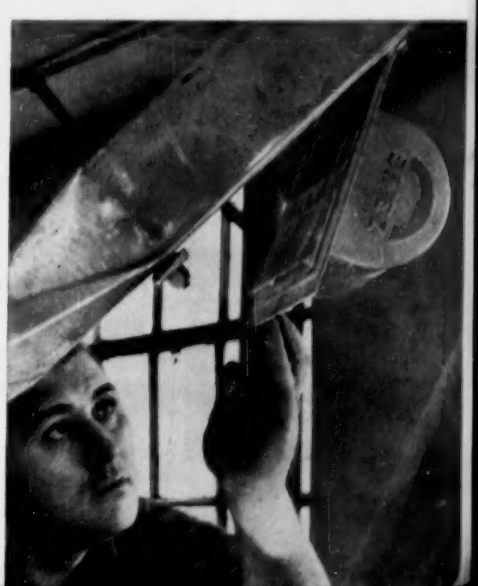
First complete line of electro-permanent magnetic vibratory equipment operating at 3600 CPM directly off an AC line. No rectifier needed! . . . just plug in. HI-VI units provide greater vibratory output with less power consumption . . . give superior performance at reduced costs. Speed production. Permanently powered Alnico V magnetic element results in exclusive "double action" drive for greater productivity. Lightweight, compact, easily installed. *HI-VI Vibratory Feeders* give accurate, controlled feed to bulk materials . . . convey, spread, agitate, blend, cool, mix, etc. *HI-VI Unit (Bin) Vibrators* (self-adjusting) keep materials pouring freely and evenly through hoppers, bins, chutes, etc. Prevent pile-ups, arching, bridging. Write for complete HI-VI literature.







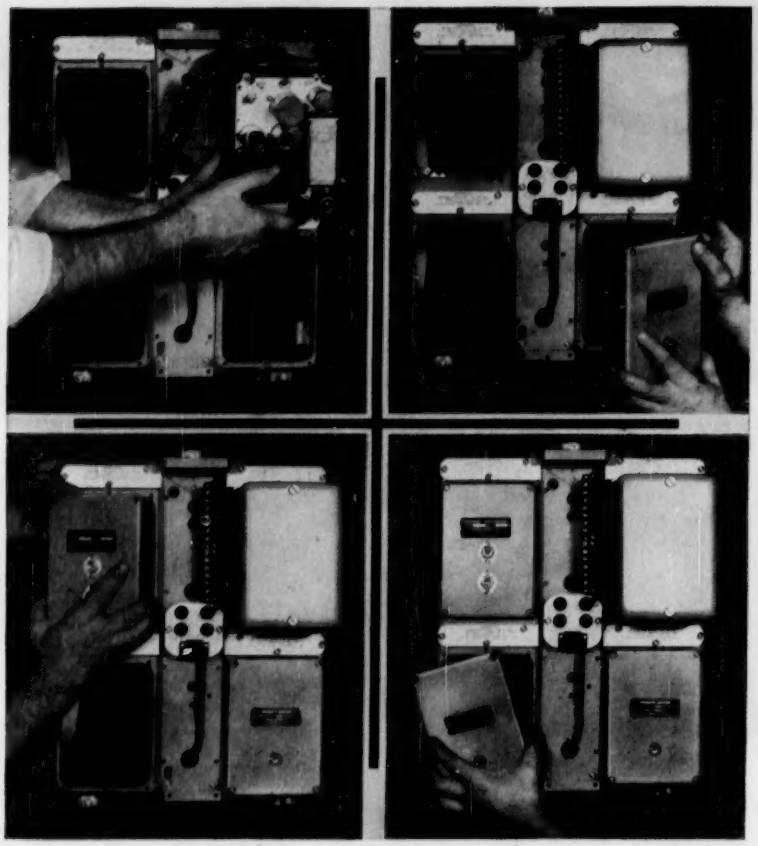
ERIEZ MAGNETIC FERROTRAPS (PIPELINE TRAPS). Utmost protection against unwanted iron damage and iron contamination for almost all materials flowing through pipelines. New design offers three to four times more magnetic area than previous traps, effectively catches larger pieces of stray metal as well as microscopic fines. Invaluable for protecting expensive equipment; a "must" where product purity is of prime importance. Model B, (above, top) has stainless steel housing, and is available in standard or sanitary models. Model L, bronze housing, is standard model only. Ferrotraps are quickly installed, easily cleaned and can be used in any position. Withstand high pressures.



HI-POWR PLATE MAGNET PROTECTS PRODUCT PURITY. At the Newark, New Jersey, plant of the Serutan Company, a system of Eriez permanent-powered magnetic separators is used to assure product purity and to protect expensive machinery from tramp iron damage. The Eriez Plate Magnet shown here is installed in a gravity flow line leading from a mixer to the pellet mills, and is daily trapping unwanted pieces of tramp iron, as well as ferrous fines. The efficiency of the Eriez Magnets, according to plant officials, has far surpassed expectations.

Eriez' free booklet "Magnetic Ideas" can help you. Send for it without obligation, ERIEZ MANUFACTURING COMPANY, 74W Magnet Drive, Erie, Pa. OR on your specific request Eriez factory-trained field men backed by Eriez' laboratory and engineering know-how, will be happy to study your particular problem, make a plant survey and offer helpful "Magnetic Ideas". ■

CUSTOM BUILD your own Bailey Recorder



These four views of the back of a Bailey Recorder show how four plug-in units may be added as needed to meet almost any recorder application.

The freedom and flexibility of "do-it-yourself" instrumentation is yours in the Bailey Recorder. A variety of plug-in units make it possible to record, control, and retransmit any variable that can be converted to a pneumatic or electric signal.

The basic plug-in units are the Bailey a-c and d-c Electronic Receivers and Pneumatic Receivers. Any four of these may be used in one recorder, intermixed in any way, to provide four continuous records on one chart.

For automatic control, other plug-in units are available.

For square root extraction or linear integration, there are two plug-in variations of the Bailey Integrator.

When you want a pneumatic signal that varies according to a pre-set pattern plug in a Bailey Program Controller.

Periodic running time of a condition or process is recorded on the chart when a Bailey Running Time Recorder is used.

These and other plug-in units are described in Product Specification E12-5. Some companies stock Bailey Recorder cases and assorted plug-in units. As instrumentation and control needs arise they build up the kind of recorder-controller required, using the proper plug-in units from stock. Unmatched versatility such as this means lower instrumentation costs.

For the complete story of how easily you can custom build this recorder to your needs, see your Bailey Engineer. G43-1

BAILEY METERS

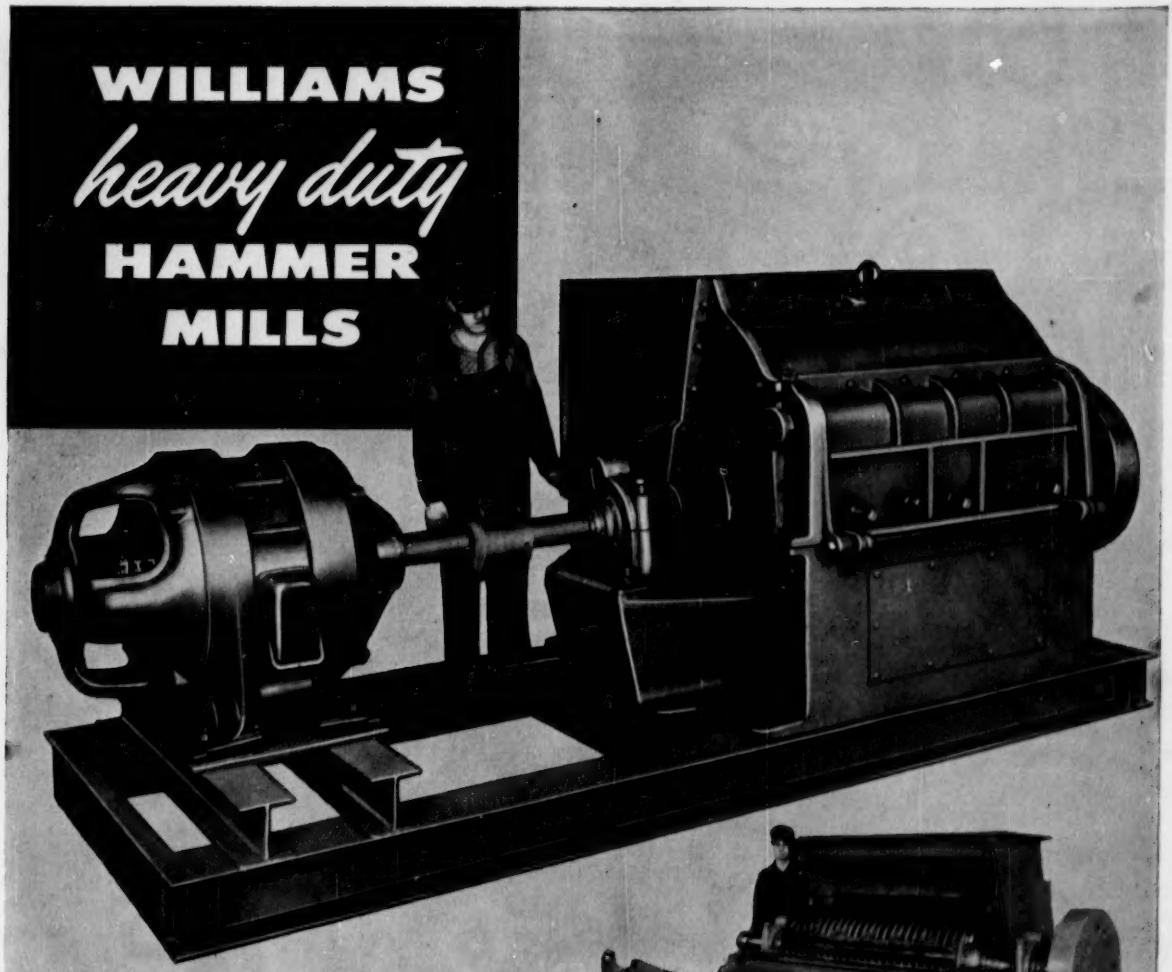
Instruments and controls for power and process

BAILEY METER COMPANY

1054 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

WILLIAMS *heavy duty* HAMMER MILLS



- **Crushes, Grinds, Shreds To Finished Size In One Operation**
- **Reduces Production Costs Up To 50%**
- **Saves Up To 75% On Equipment Cost**

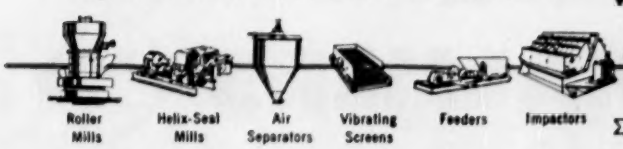
Williams No. 60 GA Mill with heavy duty steel plate frame. Cover has been opened to show heavy duty manganese steel liners, breaker plates, grate bars and hammers.

Whether your size reduction job involves crushing, grinding or shredding—whether the material is mineral, chemical, vegetable or animal—Williams has a hammer mill designed to *do it from start to finish in a single operation.* More uniform product, increased output, plus savings in time and labor can *cut production costs as much as half!*

Extra primary and secondary crushers are seldom required with a Williams—no extra drives or conveyors, no costly foundations or buildings for additional crushers are necessary. Expensive maintenance, replacement parts, excessive downtime and labor are reduced to a minimum.

Learn how a Williams hammer mill can step up your output, and improve your product quality. *Write—explain your operation—and ask for a catalog.*

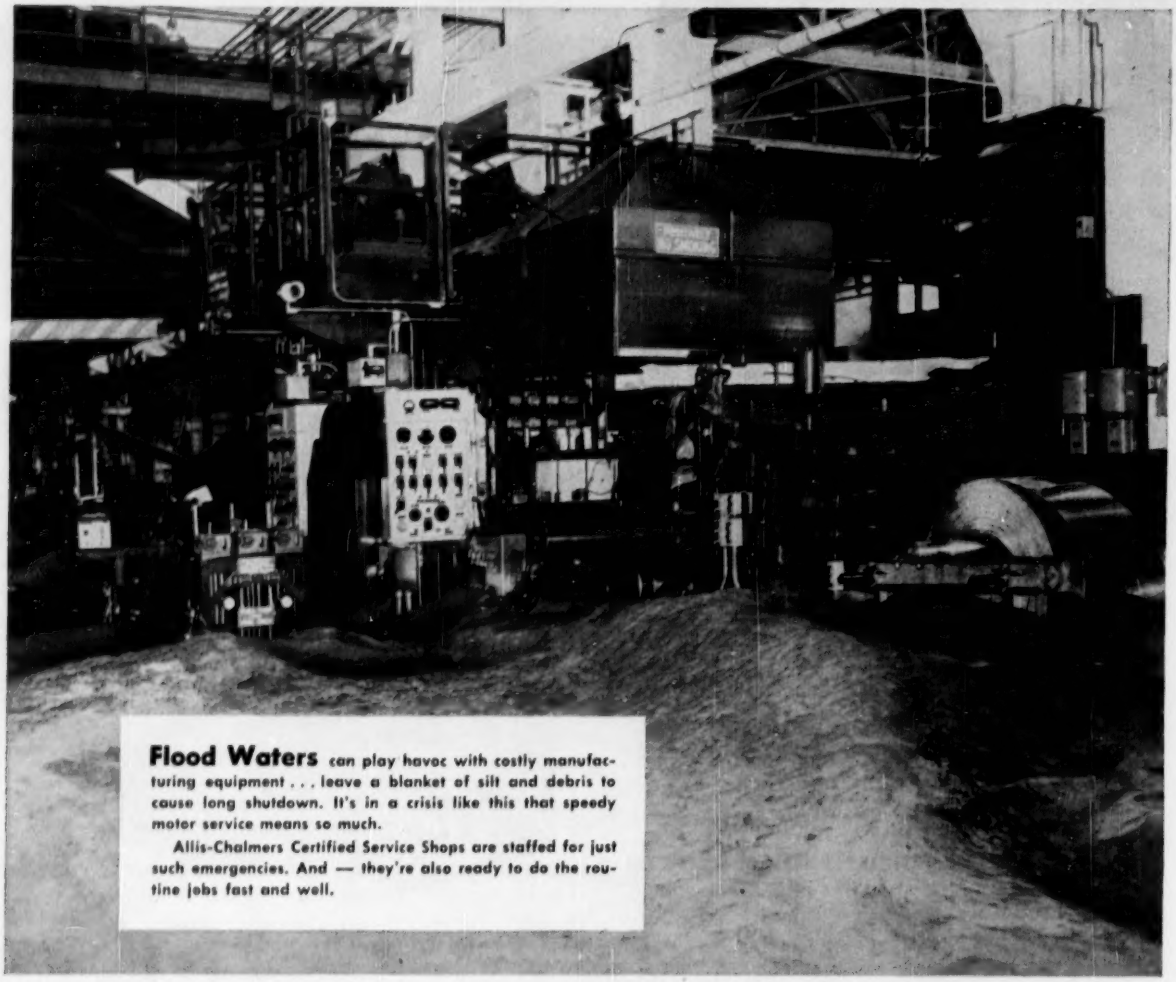
WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. 9th St. St. Louis 6, Mo.



WILLIAMS
CRUSHERS GRINDERS SHREDDERS
Oldest and Largest Manufacturers of Hammer Mills in the World

Allis-Chalmers "Certified" Service Shops:

When you need motor help



Flood Waters can play havoc with costly manufacturing equipment . . . leave a blanket of silt and debris to cause long shutdown. It's in a crisis like this that speedy motor service means so much.

Allis-Chalmers Certified Service Shops are staffed for just such emergencies. And — they're also ready to do the routine jobs fast and well.

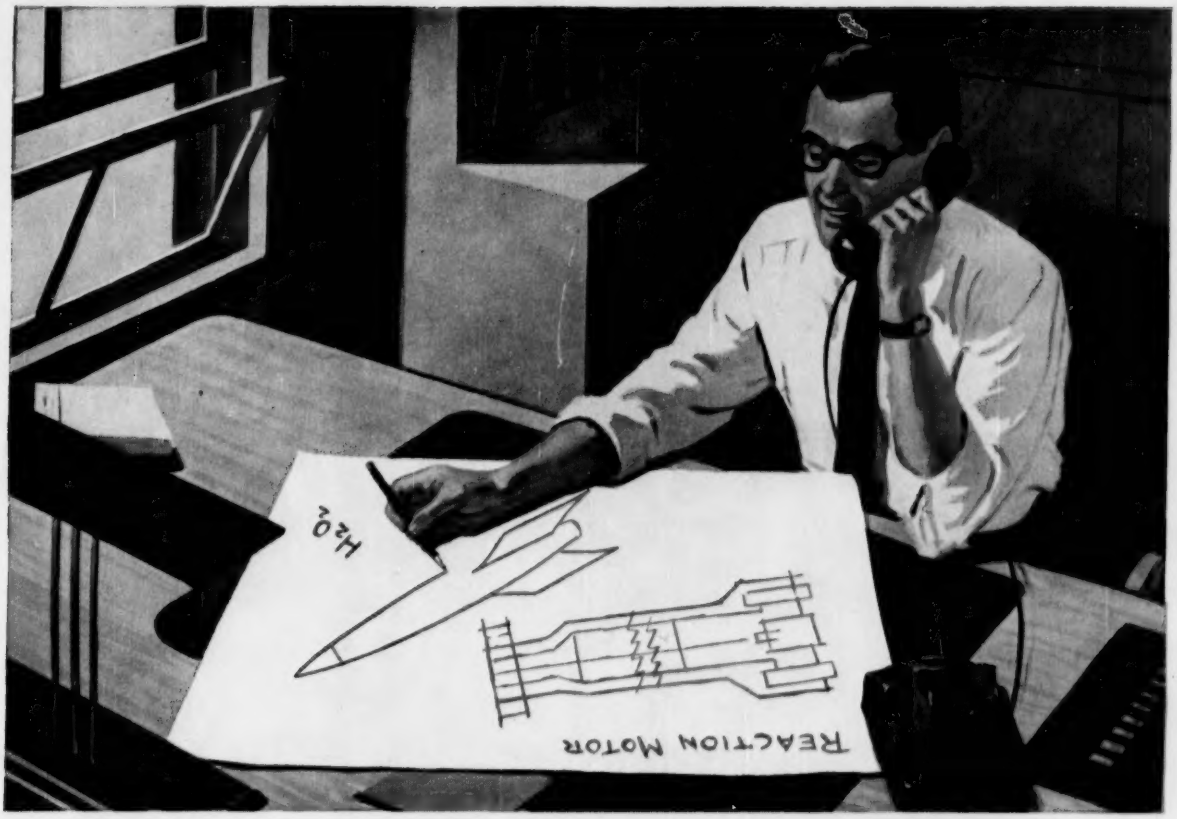
Catastrophe or Routine Service

Whether it's complete catastrophe or a normal repair job, fast motor service can make a difference of thousands of dollars in lost production. As near as your phone is one of more than 100 Allis-Chalmers Certified Service Shops — ready to help save you production dollars.

These shops have manpower and equipment to perform repairs to Allis-Chalmers rigid standards. Their ability and integrity have been proven by years of service. They can do a good, fast job on any motor or generator, of any make. To locate the Shop in your area, call your nearby A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-5140



Can Becco Research Help You with Propulsion?

Hydrogen peroxide powers reaction motors . . . operates gas turbines . . . launches planes . . . runs rotor-tip motors of helicopters.

As a monopropellant hydrogen peroxide represents a compact power source. It carries its own built-in supply of oxygen to permit combustion of hydrocarbon-type fuels in bi-propellant systems lacking an external or adequate air supply.

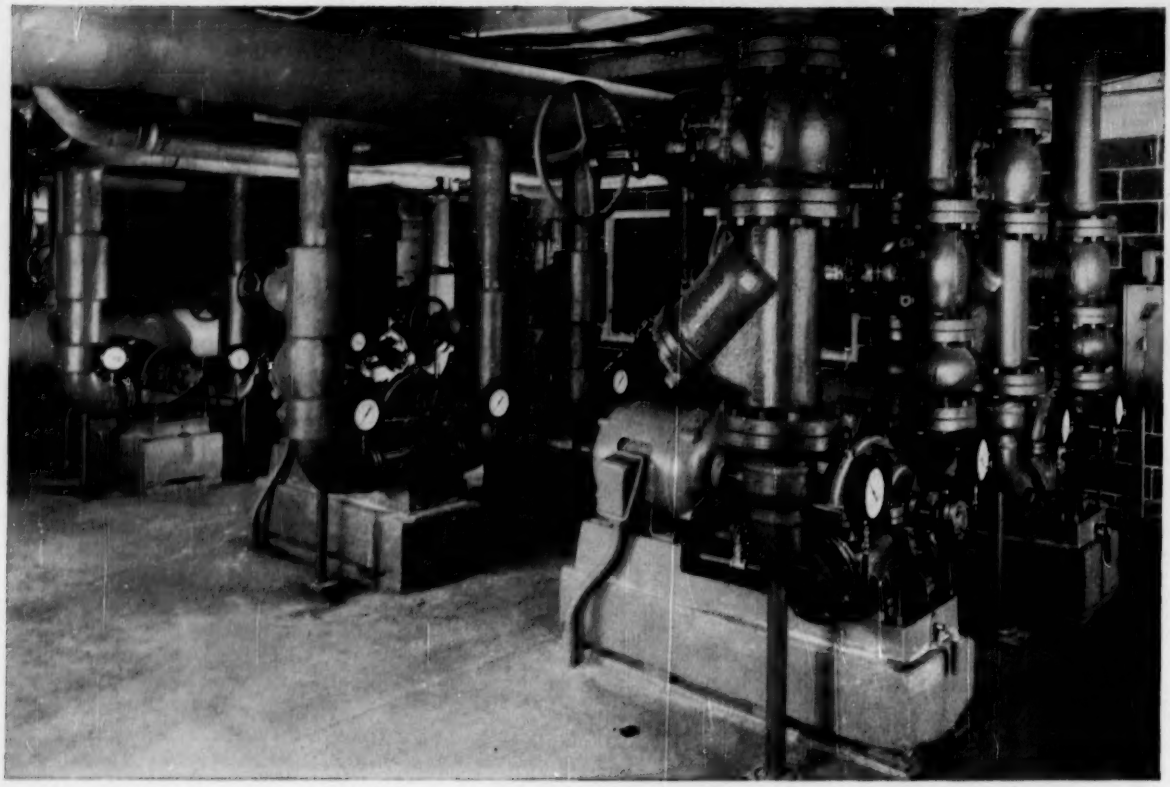
Becco Research has been an important factor in the development of hydrogen peroxide as a power source. A wealth of information and experience, collected over a decade of active research in this field, is available and ready to be applied to problems of using hydrogen peroxide as a source of energy.

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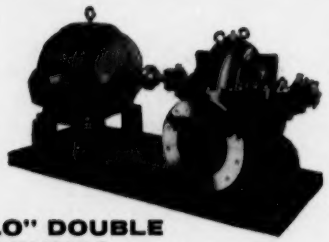
Progress in Peroxygens ® **BECCO**

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

FMC CHEMICALS INCLUDE: BECCO Peroxygen Chemicals • WESTVACO Phosphates, Barium and Magnesium Chemicals • WESTVACO Alkalis, Chlorinated Chemicals and Carbon Bisulfide • NIAGARA Insecticides, Fungicides and Industrial Sulphur • OHIO-APEX Plasticizers and Chemicals • FAIRFIELD Pesticide Compounds and Organic Chemicals



How do you guarantee successful pump installations?



Many rely on these "Buffalo" Pumps

There's a "Buffalo" Pump that's sure to fit your installation needs perfectly . . . sure to deliver the utmost in economy, reliability and long-lasting performance on the job. For *two* reasons: *First* . . . "Buffalo" builds a line of pumps covering almost every type of liquid-moving requirement. All you do is select the *one* "Buffalo" Pump that exactly matches your installation needs. *Second* . . . When you choose your "Buffalo" Pump, you can be sure you're installing the very finest. For more than 80 years, engineers and contractors have relied on the rugged, dependable quality built into every "Buffalo" Pump. You can *depend* on "Buffalo" Pumps.

Whatever your pump problem, write us for engineering data. We'll gladly submit recommendations that will help you with your liquid-moving requirements.

"BUFFALO" DOUBLE SUCTION PUMPS

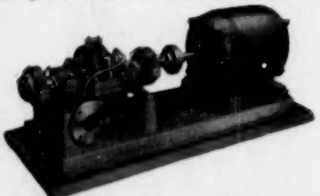
These pumps are designed for the finest performance possible in clear water service in 10 to 14,000 gpm capacities. Widely used for air conditioning service, because of their peak efficiency. Write for Bulletin 955-Q.



"BUFFALO" SINGLE SUCTION PUMPS

Husky pumps for husky jobs, with these outstanding features: oversize bearings capable of handling speeds up to 5000 rpm — sealed-in bearing housing to keep out foreign matter—enclosed impellers, to retain initial efficiency. Complete details in Bulletin 976-E.

"BUFFALO" MULTISTAGE PUMPS



"Buffalo" Type "RR" Multistage Pumps are highly efficient for high pressure applications with clear water. Ideal for boiler feed service. Available in two and four stage designs, up to 900 gpm and 500 lbs. Write for Bulletin 980-D.

BUFFALO PUMPS
Division of Buffalo Forge Co.
501 Broadway Buffalo, N.Y.
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

TRUFIN EASY TO USE WHEN RETUBING UNITS

An outstanding feature of Wolverine Trufin is the ease with which it can be substituted for plain tube during retubing operations. In manufacturing, Trufin's ends are left plain. Each end has a heavy wall section which is approximately two gauges heavier than the finned portion of the tube. Result: greater rolling or brazing flexibility at the header. The heavy ends also provide greater protection against inlet erosion.

WOLVERINE TRUFIN CUTS DESIGN COSTS

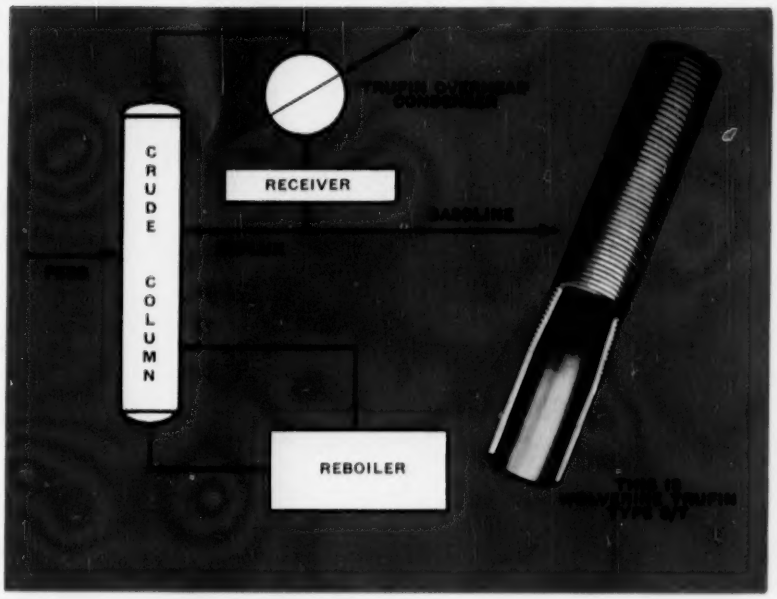
Heat exchangers and condensers designed around Wolverine Trufin Type S/T, can in many cases, be fabricated more economically than with plain tube.

The use of Trufin—with its extended surface—for example, can reduce the number of lineal feet of tubing required to obtain a given heat duty. Fewer tubes mean, in turn, smaller shells, baffles and headers plus a substantial savings in labor. If the unit is to be used in overhead service there is also a saving in the amount of material normally required for superstructures.

NEW BOOK OFFERS COST COMPARISONS

Direct cost comparisons between the use of Wolverine Trufin and prime surface condenser tubing in heat transfer applications are given in Wolverine's new book "Comparative Heat Exchanger Costs." Just off the press, this new book contains valuable information—should be in the reference file of every processing engineer. Write today for your copy.





Retubing Does The Trick:

INTEGRALLY FINNED TUBE BOOSTS DEPROPANIZER CONDENSER OUTPUT

BY ERNEST DODD

Up until recently, in heat transfer work, a refinery engineer didn't have much choice when he wanted to increase heat duty. He could design a bigger unit—with increased surface area—or he could add another unit to those already on stream—providing of course, that he had sufficient room.

Well, it isn't that way anymore.

Nowadays—thanks to Wolverine Trufin® Type S/T—the refinery engineer can increase heat duty simply by retubing with integrally finned Trufin Type S/T. This is exactly what engineers at a west coast refinery did when they needed increased heat duty from an overhead depropanizer condenser on their fluid catalytic cracking unit.

After Trufin Type S/T—446 pieces, 16-feet long to be exact—had been substituted for the plain tube bundle, the initial boost in heat duty was 48%—a highly gratifying figure to all concerned. But that wasn't all.

During its days as a plain tube unit, this condenser had to be taken off stream for frequent cleanings. With Trufin Type S/T in the bundle, the unit has been in production for a full year without requiring cleaning—the first time this has ever happened.

Naturally there's a logical reason for this improved performance.

Wolverine Trufin Type S/T is an extended surface tube—gets its increased surface area from its integral fins which are actually squeezed from the tube wall. Because of this, Trufin has approximately 2½ times more surface area than does an equivalent piece of plain tube. Percentage wise this is an increase of 150%. It is this increased surface area that permits Trufin Type S/T to extract more BTU's per foot of tube.

Tests and authenticated case histories show that when Trufin fouls, the scale buildup follows the fin profile instead of preferring the valleys between the fins. Because Trufin does not present a flat surface, there is a tendency for the scale to fall away—which explains why Wolverine Trufin resists fouling and stays on stream for longer periods than prime surface tube.

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SALES OFFICES IN PRINCIPAL CITIES
EXPORT DEPARTMENT, 11 EAST 40TH STREET, NEW YORK 16, NEW YORK
Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

FINNED TUBE BOOKS AVAILABLE—FREE!

Wolverine Tube, from its years of experience, has compiled and published literature of great interest to those engaged in heat transfer work. Among its catalogs and booklets are the COMPARATIVE HEAT EXCHANGER COSTS BOOK, TRUFIN CATALOG, CONDENSER TUBE CATALOG, PROCESS FLOW SHEET BOOK, WOLVERINE CORROSION CHART and the TRUFIN WATER HEATER BOOK. Any—or all—of these are yours—FREE. Why not write TODAY.

We've Been Asked:

WHEN TALKING OF WOLVERINE TRUFIN® WHAT DO YOU MEAN BY TYPE S/T?

BY ERNEST DODD

In addition to pioneering in the development of integrally-finned condenser tube, Wolverine Tube has also been responsible for coining the various designations used to describe different types of integrally finned tubing. Because of the increasing popularity of Wolverine Trufin®, we are often asked to explain just what these designations mean.

Actually, Wolverine Trufin is available in six different types—each designed for use in specific heat transfer applications. The most widely used is Trufin Type S/T named by Wolverine to identify its use in shell and tube condensers. Trufin Type S/T is a low finned tube with either 16 or 19 fins per inch (depending on alloy). The ratio of outside-to-inside surface area is approximately 3.75 to 1.

Wolverine also produces Trufin Type W/H, so named because it was designed primarily for use in water heaters. Trufin Type W/H is a high finned tube with 11 fins per inch. It has an outside-to-inside surface ratio of approximately 4.75 to 1.

To help the processing industry do a better hydrocarbon cooling job Wolverine developed an all-aluminum Trufin tube with integral fins on the outside and longitudinal fins on the inside. This tube is called Trufin Type I/L (internal longitudinal). It is available with 5, 7, 9, or 11 fins on the outside and has sufficient fins on the inside to approximately double the surface area. In addition to hydrocarbon cooling, Trufin Type I/L is also ideal for air cooling oil or in air-type refrigeration evaporators.

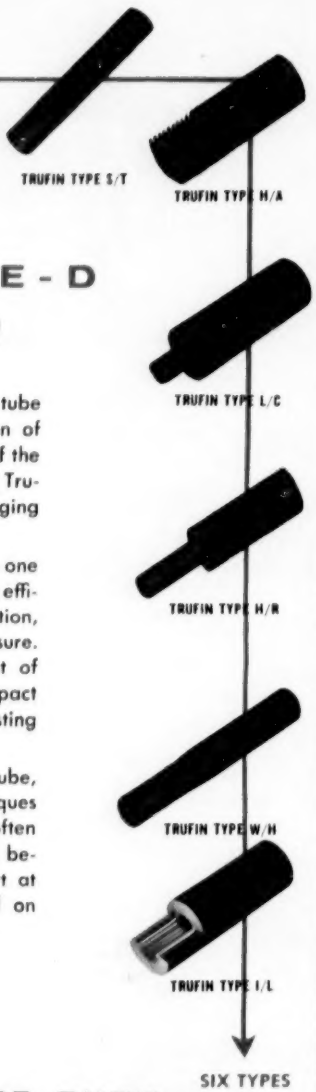
Trufin Type L/C is a high finned-lightweight aluminum tube mechanically bonded to an interior liner of any metal. Type L/C was designed to economically provide an extended surface tube with a liner core permitting adaptation to a variety of corrosion and/or pressure requirements. Type L/C, too, is ideal for air-cooled operations.

To facilitate insert type end connections by brazing, Wolverine developed an extended surface tubing with a controlled inside diameter—named it Trufin Type H/A (high area). Trufin Type H/A is a high finned tube with an outside-to-inside surface ratio of approximately 8:1. Air or gas flows outside the tube to be heated or cooled. The condensing or evaporating liquid is passed through the inside of the tube.

Finally there's Trufin Type H/R (high root)—similar to Type H/A. The root diameter is closely controlled and sufficient wall thickness allowed to permit the removal of fins for rolling into tube sheets. Type H/R is a high finned tube—has an outside-to-inside surface ratio of approximately 8:1.

And there, briefly, is a look into the background of integrally finned condenser tubing—a Wolverine development that is becoming more and more important with the passing of each day.

LOOK



FINS actually

E-X-T-R-U-D-E-D

from the tube wall!

The fact that its fins are part of the tube wall is the secret of the construction of Wolverine Trufin. It's the secret too, of the amazing performance records which Trufin-tubed heat exchange units are hanging up every day.

Because the fins and tube are all one piece, you are assured of constant efficiency. Fins are not impaired by vibration, temperature change or varying pressure. Trufin transfers *more* BTU's per foot of tube—permits you to design more compact units—steps up the capacity of existing ones.

Trufin is fabricated as easily as plain tube, too. In fact, standard tools and techniques are used. Fabricated Trufin units are often stronger than units using plain tube because fins provide additional support at bends. Remember: You can *depend* on Trufin for *dependable* heat transfer!

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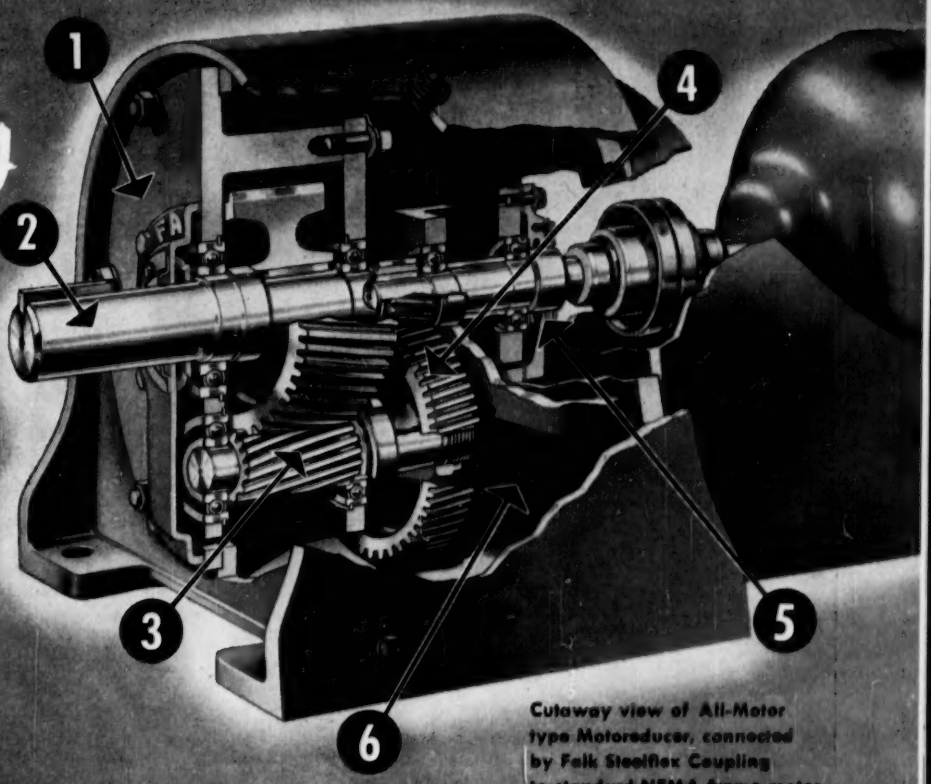
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Here's the inside story—



Cutaway view of All-Motor type Motoreducer, connected by Falk Steelflex Coupling to standard NEMA frame motor

WHY Falk Motoreducers give better service—have longer life

Here is the "inside story" behind the all-steel All-Motor type FALK Motoreducer's universal reputation as a gear drive unmatched in quality, efficiency, dependability, ease of maintenance and long life. These "In-built" factors are—

1 ALL-STEEL HOUSINGS. Rugged, strong, rigid...all parts are manufactured from heavy steel plate, formed and welded in the Falk Weld Shop.

2 LARGE OVERHUNG LOAD CAPACITY. Large shafts, oversize bearings...rigid mountings with wide bearing spans to handle maximum applied loads.

3 PRECISION GEARING. Heat-treated alloy steel gearing, precision cut and shaved after heat treatment to eliminate distortion. Quiet, crown-shaved pinions.

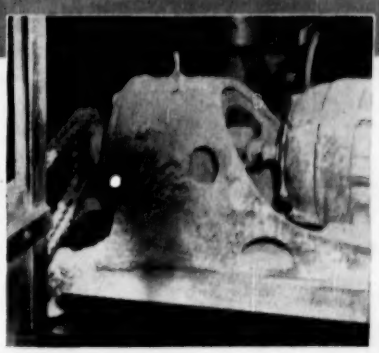
4 EXTRA-CAPACITY GEARING. Special extra-capacity gear-tooth form with larger contact area gives greater strength, higher load-carrying capacity.

5 SEALED HOUSINGS. Splashproof, dustproof, oil-tight construction. Dual closures and one-way vents keep oil in, dust and moisture out.

6 POSITIVE LUBRICATION. Large sump capacity...oiltight construction assures clean lubricant...revolving elements lubricated by direct dip.

When you buy or specify the All-Motor type FALK Motoreducer, you get all these—plus the tremendous advantage of full interchangeability of motors. Switch motors as desired—use any make, style or type of standard foot-mounted motor within the unit's AGMA rating—with a minimum of difficulty or "down time."

Available in sizes up to 75 hp—*with or without motor*—from convenient factory, field or distributor stocks, from coast to coast. **Write for Bulletin 3100.**



60,000 HOURS WITHOUT A FAILURE!

Sixty thousand hours is a lot of hours—but the FALK Motoreducer in the unretouched photo above has served that long without failure or need of repair.

This 3 hp unit is one of over 60 FALK Motoreducers in daily service in an Eastern plant of a large milling company, whose president says, in part:

"One of the main advantages of FALK Motoreducers is their adaptability to any motor. Reducers and motors can be easily interchanged....Our service records confirm the wisdom of our choice of FALK equipment as our standard."

FALK ...a good name in industry

THE FALK CORPORATION, MILWAUKEE, WISCONSIN

MANUFACTURERS OF

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining



Let Harshaw Catalysts do a GIANT'S work for you

Harshaw Catalysts do a giant's work and Harshaw produces catalysts in giant quantities—carloads every week. A letter or phone call will put our 20 years' experience and acres of production and research facilities to work for you.

PREFORMED CATALYSTS
to fit special process requirements

Hydroforming
Cyclization
Oxidation
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Isomerization
Hydrogenation



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Aluminum Nitrate — Cobalt Nitrate
Copper Nitrate — Manganese Nitrate Solution
Metallic Soaps (Cobalt, Manganese)
Nickel Carbonate — Nickel Formate — Nickel Nitrate
Nickel Sulfate — Sodium Methoxide — Zinc Nitrate

Our experienced technical staff will assist you in developing the best and most economical catalyst. If you have a catalytic process in the development or production stage, a discussion with us may prove beneficial.

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SPHERES


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FLAKES

COPPUS SENTRY® VALVES

Stop flow instantly

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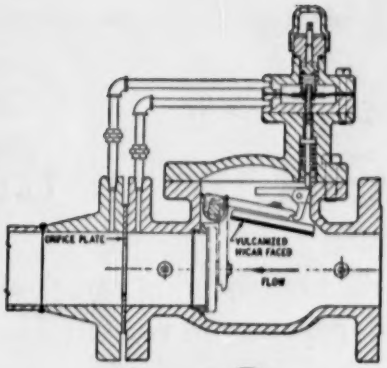
Start flow instantly

Automatically

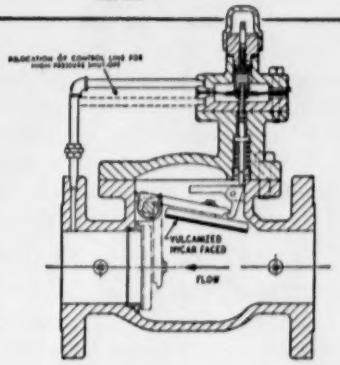
And when they flow, it's full flow

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

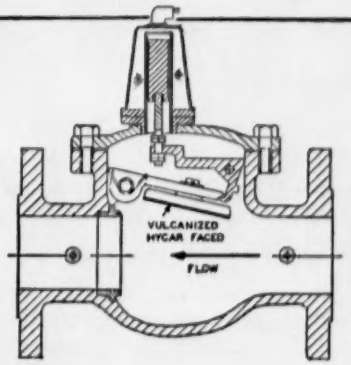
MODEL 1200 SENTRY EXCESS FLOW SHUT-OFF VALVE — shuts off gas or liquid instantly when flow exceeds predetermined rate.

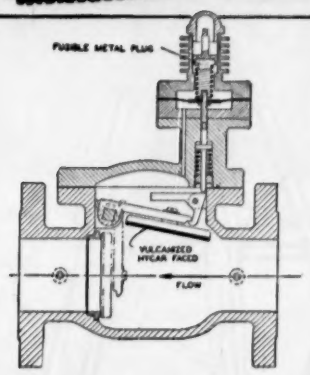


MODEL 1500H SENTRY HIGH PRESSURE AND MODEL 1500L LOW PRESSURE SHUT-OFF VALVES — shut off gas or liquid instantly when predetermined pressure limits are reached.

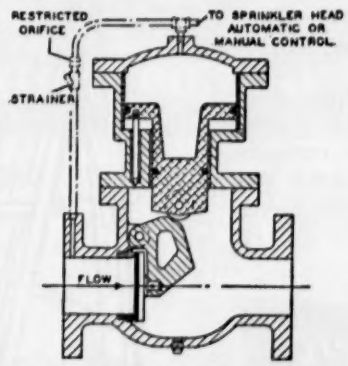


MODELS 1700 AND 1800 SENTRY SOLENOID SHUT-OFF VALVES — shut off gas or liquid instantly by remote electrical control.





MODEL 2200 SENTRY OVERPRESSURE AND OVERTEMPERATURE SHUT-OFF VALVE — shuts off gas or liquid instantly in case of excessive pressure or ambient temperature.



MODEL 3000 SENTRY PISTON OPERATED QUICK-OPENING VALVE — starts gas or liquid flow instantly when pressure in piston chamber is released. Ideal for deluge system and for automatic opening and closing by instrument-air or electrical control.

COPPUS ENGINEERING CORP.
229 PARK AVENUE
WORCESTER 10, MASS.

Please send information on Sentry Valve model 1200 ☐, 1500H and 1500L ☐ 1700 and 1800 ☐, 2200 ☐, 3000 ☐.

Name.....

Company.....

Address.....

City.....

State.....

Get up in the world!

Your engineering career will thrive on the opportunity at Western Electric

How would you like to work in a place where there's a constant need for new products, new processes, new ideas? Where the technical job brings engineers in touch with such broad managerial functions as production, merchandising, installation, and many others? Where promotion from within is the policy . . . and over 8,000 management positions must be filled in the next ten years by newly promoted people?

Sounds good, doesn't it? Well, that's the kind of opportunity that awaits you at Western Electric. Here engineers shoulder key responsibilities in our job of making, distributing and installing Bell telephone equipment . . . in carrying out, at government request, major defense contracts such as the Nike guided missile system and Sage, the continental defense system.

As a member of this team you'd handle challenging assignments that could involve electronic switching, automation, radio relay for TV and long-distance calls. Your ideas would be welcome . . . you'd learn . . . you'd grow!

What's more, you'd be given every encouragement to grow. We sponsor a full-time Graduate Engineering Training Program during working hours to help new engineers more rapidly assume a full engineering role and to increase the capabilities of experienced engineers. We also offer a Tuition Refund Plan for out-of-hours study at nearby colleges.

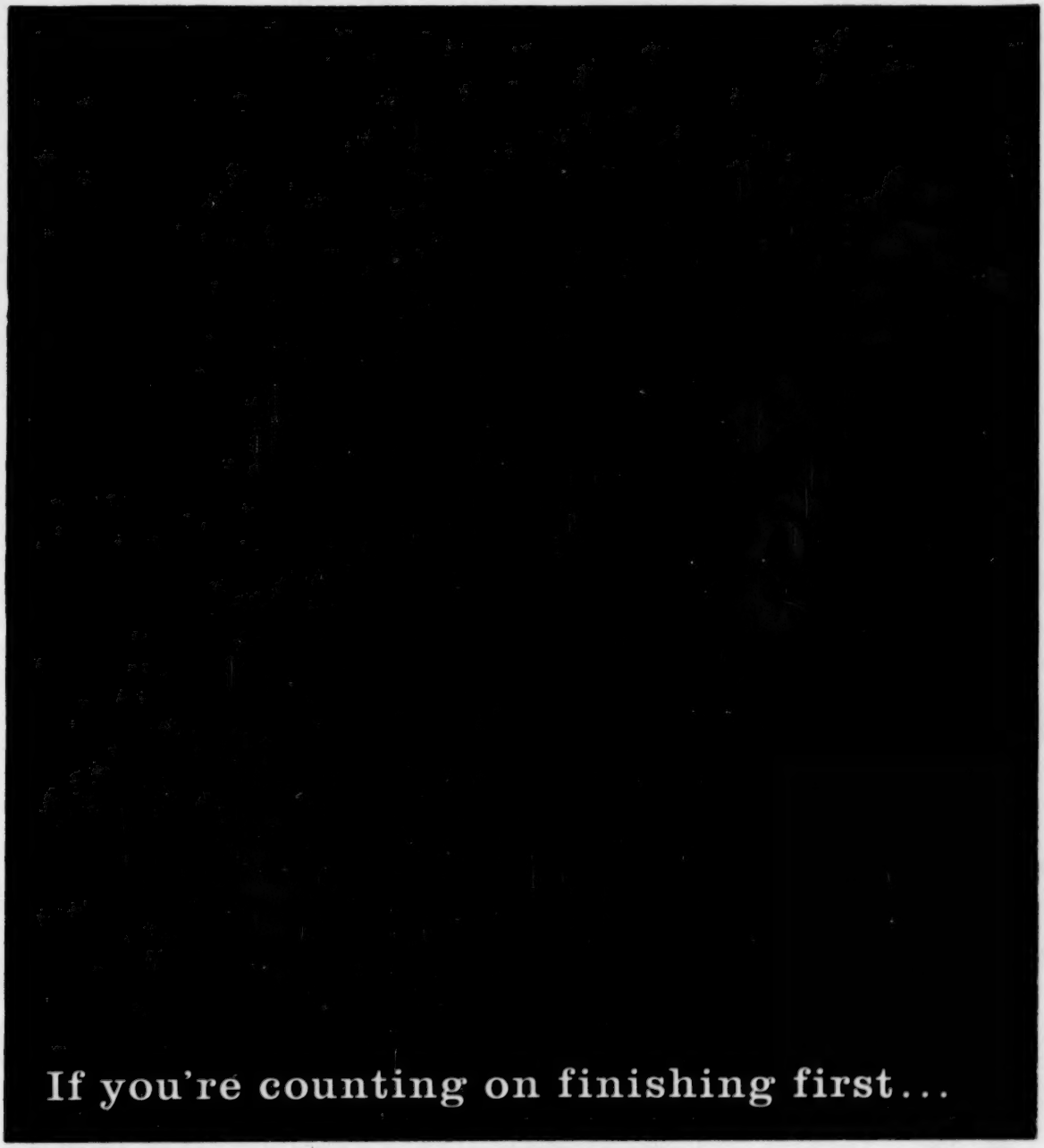
You owe it to your ideas and your future to determine the openings for which you may be qualified (mechanical, electrical, chemical, civil engineers, physicists and mathematicians). To apply, send resume of education and experience to Engineering Personnel, Room 1067, Western Electric Co., 195 Broadway, New York 7, New York.



Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

Manufacturing plants in Chicago, Ill.; Kearny, N. J.; Baltimore, Md.; Indianapolis, Ind.; Allentown and Laureldale, Pa.; Burlington, Greensboro and Winston-Salem, N. C.; Buffalo, N. Y.; North Andover, Mass.; Lincoln and Omaha, Neb.; St. Paul and Duluth, Minn. Distributing Centers in 30 cities and Installation headquarters in 16 cities. Also, Teletype Corporation, Chicago 14, Illinois.



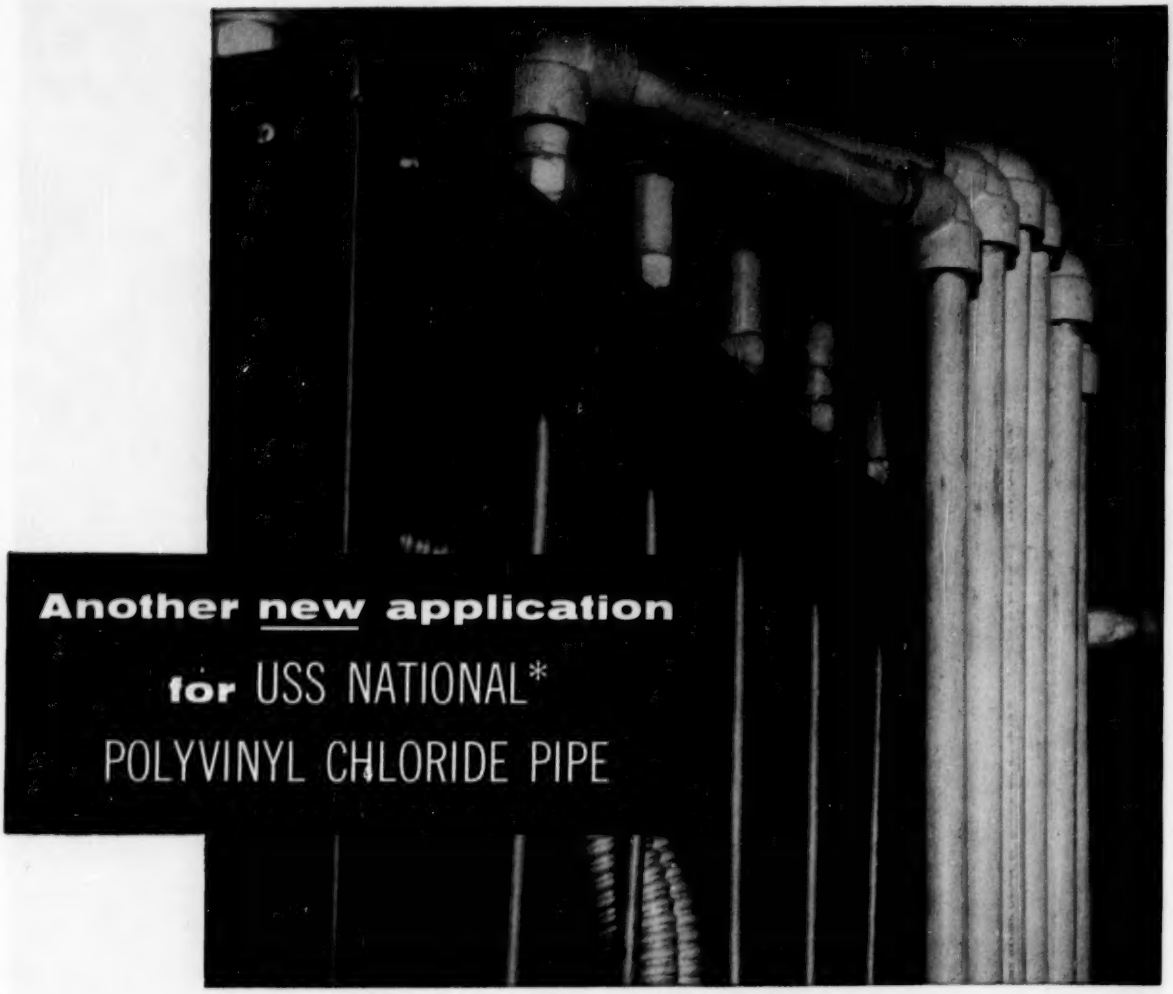
. . . start with SOLVESSO 150. Unsurpassed in *uniformity* and *purity*, it has long been a standard ingredient in the finest baking-alkyd surface coatings in the automotive industry. The entire family of Solvesso Aromatic Solvents is known for setting standards *throughout* the surface coating industry. Their distribution through a highly developed supply system geared for peak efficiency, and utilizing modern, proven handling methods, assures industry that these vital ingredients are *always* immediately available for prompt delivery. "If You're Counting On Finishing First," start with Esso Petroleum Solvents. Write or phone today! Esso Standard Oil Company, Inc., 15 West 51st Street, New York 19, New York.

SOLVESSO 150

Esso

SOLVESSO TOLUOL · SOLVESSO XYLOL · SOLVESSO 100 · SOLVESSO 150
A FAMILY OF FOUR AROMATICS FOR ALL OF INDUSTRY'S REQUIREMENTS } PETROLEUM SOLVENTS

"SOLVESSO 150"—Reg. U.S. Pat. Off.



. . . carrying blast furnace gas

Here's another example of the versatility of NATIONAL PVC Pipe. Used as part of a gas detection system in a boilerhouse-power station, the high-impact pipe transports blast furnace gas at temperatures up to 100°F., from the furnaces to the testing laboratory. Approximately 14,000 feet of NATIONAL Polyvinyl Chloride Pipe were used in this installation. And it has proved ideal for the job.

Polyvinyl Chloride, the "stainless" of plastic pipe materials, is tough and rigid, immune to acids, alkalis, salts, fungi, bacterial action and soils, as well as a multitude of chemicals. It won't corrode. It will carry just about anything—wet or dry natural gas, oil, chemicals.

NATIONAL PVC Pipe may be coupled by solvent cementing, threading, heat welding, or adhesives. And it can be used in overhead installations with pipe supports.

Two types of NATIONAL PVC Pipe are available in sizes ½-inch to 6-inch inclusive, and in Schedules 40, 80 and 120.

NORMAL IMPACT—for installations requiring the highest chemical resistance attainable, together with high strength and excellent creep resistance.

HIGH IMPACT—for installations requiring excellent chemical resistance and a high degree of toughness even at low temperatures.

**Trademark*

A bulletin on National PVC Pipe is available free of charge. Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Ask for Bulletin 24.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

This seal of the National Sanitation Foundation is carried on all USS National Polyvinyl Chloride Pipe and means—Tested . . . Approved . . . Sanitary!

nSf

USS

NATIONAL PVC PIPE

UNITED STATES STEEL

ROKIDE* Spray Coatings Protect the Widest Variety of Parts

Some of many possible applications

BAFFLE PLATES
BEARING SURFACES
CRUCIBLES
METAL ROLLS
FEED ROLLS
NOZZLES
PUMP SHAFTS
GAS TURBINE PARTS
DUCT LININGS
EXHAUST PORTS
THERMOCOUPLE TUBES
THERMOCOUPLE WIRE
GENERAL WIRE
MECHANICAL SEALS



Applying ROKIDE Coating to pump shaft.

The three types of ROKIDE spray coatings — "A" aluminum oxide, "ZS" zirconium silicate and "Z" zirconium oxide — are hard, adherent, crystalline refractory materials. They can be applied to underlying parts, particularly metals, of a wide variety of shapes and sizes.

Parts on which ROKIDE spray coatings are especially useful are those requiring thermal or electrical insulation . . . refractoriness . . . resistance to wear or corrosion . . . high melting points . . . excellent mechanical strength . . . dimensional stability . . . relative chemical inertness.

The coatings are proving their great protective values in a rapidly growing number of applications. Included are not only the newer fields, such as the manufacture of missiles, ram jets, nuclear reactors, etc. Industry in general, including foundries, metal melting, heat and power plants — plus makers of automotive engines, electrical and electronic products, heavy and light chemicals, ceramics, and pumps — are also safeguarding many different parts with these new Norton developments.

Facilities for applying ROKIDE coatings are maintained at Norton Company, Worcester, Mass., and at its plant 2555 Lafayette Street, Santa Clara, California.

For the latest ROKIDE Bulletin, write to NORTON COMPANY, 800 New Bond St., Worcester, Massachusetts.

NORTON
NEW PRODUCTS
Making better products . . . to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones
Behr-cut Tapes

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

stop condensate backup



Nicholson steam traps discharge condensate and air from steam lines and equipment *faster* than any other trap of comparable size . . . help you make full use of your steam dollar. The reason—the effective use of a large orifice. A ½" Nicholson trap has a greater discharge capacity than most 1¼" traps . . . and costs less, too!

And that's not all. With just one thermostatically-operated moving part, there's nothing to get out of order, nothing to go wrong. Nicholson means continuous and low-cost operation of your steam-using equipment . . . no downtime from trap failure.

- **powerful valve action . . . no mechanical linkages to cause trouble.**
- **small and lightweight . . . easy to pipe and support.**
- **each unit steam-tested before shipment.**

So, to get a trap that discharges faster, saves money, specify Nicholson. W. H. NICHOLSON AND COMPANY, 14 OREGON ST., WILKES-BARRE, PA. *Sales and Engineering offices in 98 principal cities.*

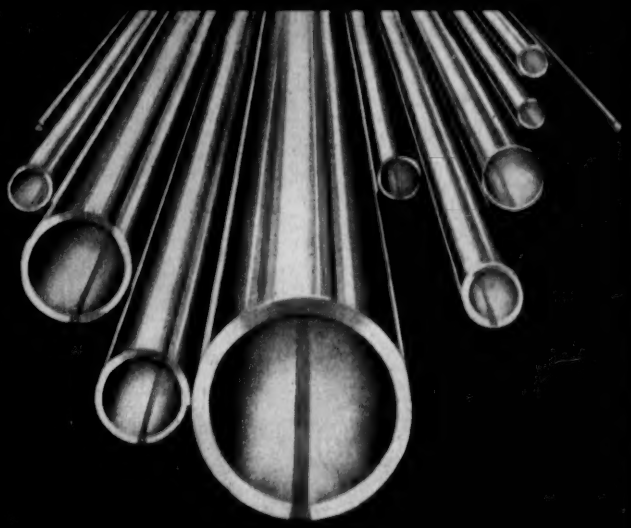


Write for Bulletin 1055

NICHOLSON
of Wilkes-Barre

New book tells full story of stainless pipe and tubing





CONTOUR TRENTWELD

HIGH ALLOY

TUBING

1/8" to 40" O.D.

TRENT TUBE COMPANY East Troy, Wisconsin

If you use stainless or high alloy pipe or tubing, this new illustrated handbook was written for you. It's 48 pages big – packed with informative data that you'll refer to again and again.

The table of contents is too long to list here, but it includes, for example, analysis and conversion tables, corrosion characteristics, weights, alloy properties, bending, joining and installation hints.

We can't guarantee how long the supply will last. To be sure of getting your free copy, why not clip and mail the coupon now?

CONTOUR TRENTWELD® **TRENT TUBE COMPANY**

A Subsidiary of Crucible Steel Company of America
GENERAL OFFICES: EAST TROY, WISCONSIN
MILLS: EAST TROY, WIS.; FULLERTON, CALIF.

Trent Tube Company
East Troy, Wisconsin

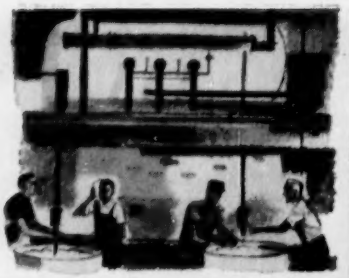
Please send me a copy of your new tubing handbook.

Name_____

Address_____

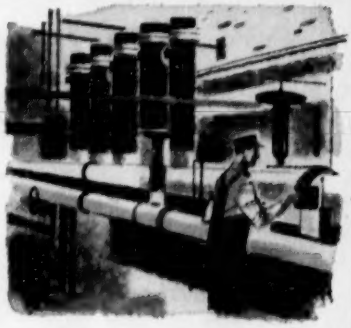
City_____ Zone____ State_____

Chromalox® Electric "Job-side Heating" for anything that's piped



WATER—Factory heats water for washroom

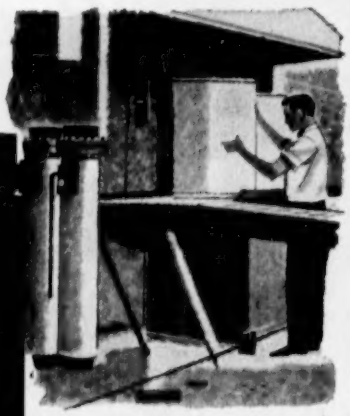
During summer boiler shut-down, this company uses Chromalox Circulation Heaters and a ceiling-mounted storage tank to provide hot water for after-work clean up. Tapped steel mounting lugs factory-welded to the heaters made installation quick and easy. Water is heated mainly at night with offpeak power at lowest rates.



AIR—Aircraft factory heats air for thermodynamic testing

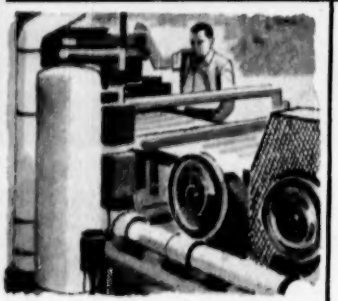
This nationally prominent aviation company installed seven Chromalox Electric Circulation Heaters to pre-heat air used for product testing. Four 80 kw heaters are rated for a maximum air flow of 450 lbs. per minute at 285 psi. Air enters the circulation heaters at from 90-210°F and is raised to a maximum of 900°F. Three 50 kw heaters have a maximum air flow of 250 lbs. per minute at 100 psi.





TRANSFER FLUIDS—Container manufacturer circulates hot oil to melt wax

As fibre drums leave this manufacturer's production line, a wax coating is applied for a smooth, grease-proof, moisture-proof interior. For a uniform coating of the desired thickness, wax must be sprayed at a constant 240°F temperature. A nozzle sprays wax up into the inverted drums as they are placed on a drain rack. As excess wax drains to a basin beneath, it is reheated and used again. The catch basin is heated by a transfer of heat from coils containing hot oil. Two 15 kw Chromalox Circulation Heaters are thermostatically controlled to keep the oil at a uniform 400°F. A separate thermostat maintains the 240°F wax temperature in the reservoir.



STEAM—Printing plant boosts steam temperatures to speed ink drying

A Chromalox Electric Circulation Heater is mounted alongside this press to boost steam temperature to 750° and eliminate the need for excessive boiler pressure. Although steam temperature takes a quick drop after leaving the heater, it still reaches the paper web at much higher temperatures than when the boiler alone was used and the steam had to travel a long distance.

Get the full story about Chromalox Circulation Heaters from your Chromalox Representative or write us direct for Bulletin 701 and new Case Studies.



CHROMALOX
ELECTRIC HEAT

Edwin L. Wiegand Company

7514 Thomas Boulevard
Pittsburgh 8, Pa.

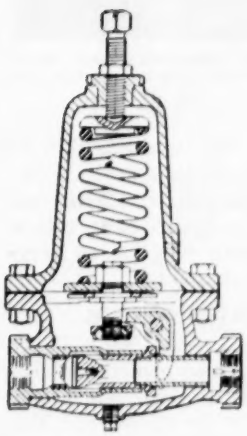
C-2128A



For better molded products...

CASH STANDARD type 1000 VALVES

keep mold temperatures in the "Safety Zone"



In the production of molded parts, uniform quality is assured through careful control of time, temperature, pressure and other factors in the molding cycle.

A leading producer of precision molded plastics parts is General Electric Company's Plastics Department, Decatur, Ill. On G-E's compression molding machines, almost 200 Cash Standard Type 1000 Reducing Valves are in use, keeping mold temperatures constant by controlling the steam supply.

Donald F. Thompson, G-E's Supervisor of Plant and Facilities Engineering, says: "For our particular application, where we use a large number of reducers, it is essential that the initial cost and maintenance cost be held to a minimum. We have found that Cash Standard 1000's have done the job very effectively."

The unique construction of this valve provides high capacity and accurate control of steam, water, air, oil and most gases and chemicals. Exclusive streamlined inner valve eliminates turbulence; flow through valve housing is in a straight uninterrupted line; an aspirating effect controls valve opening by amplifying slight pressure changes into large valve operating forces.

What's *your* control problem? Contact the Cash Standard control specialist in your area for more information on this unusual valve and other Cash Standard control products, or write Dept. A.

CASH CS STANDARD

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P.O. Box 551, Decatur, Ill.

Pressure, Hydraulic, Temperature, Process and Combustion Controls

UNICHROME

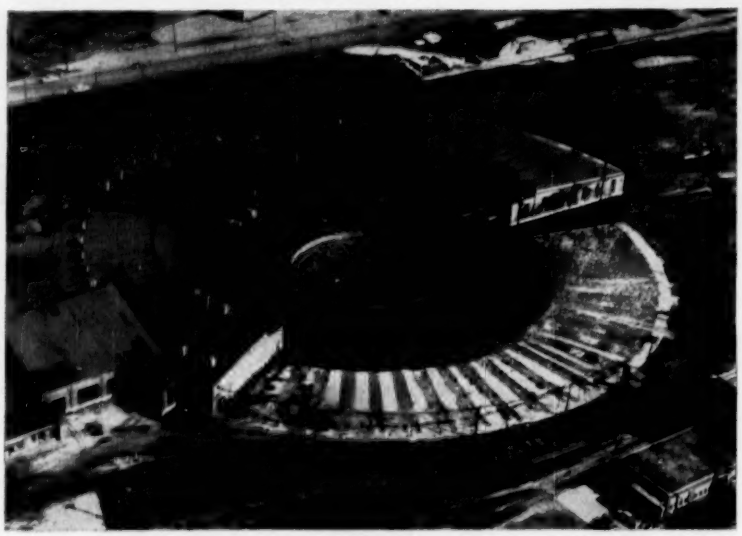
News about

COATINGS for METALS

Metallic.....Organic.....Decorative.....Protective

Phenolic linings improved for tank use

Unichrome Series B-124 Linings give reliable protection — are now being applied by specialists



Ingenuity! Lithcote Corp., a prominent applicator of Unichrome Phenolic Coatings, has adapted a former railroad roundhouse to line tank cars. Cars are sprayed, switched to the baking facilities, and can then be sent rolling back to the customer in short order.

Phenolic-type coatings, the acknowledged "workhorse" for tank lining applications, have a long and successful record in corrosive service. They'll be specified even more now that two problems have been overcome by Metal & Thermit.

(1) Unichrome Phenolic Coatings have been developed that assure more uniform linings, greater impact resistance, and improved protection. (2) Experienced, independent applicators across the country now make it possible to ship large equipment to the nearest specialist, get fast service, save on transportation.

UNIQUE PHENOLIC COATINGS

Several pigmented materials in the Unichrome B-124 Coatings group give 2-mil thicknesses per dry coat. This is twice that of ordinary phenolic coatings. Fewer coats are needed. Clear coatings in the group bake into a hard, smooth film for an easy-to-clean top coat.

BUILT-IN CONTROL

Unichrome Coating B-124-17 is a widely specified phenolic formulation that is gray when wet, olive drab when fully cured. This cure-control offers reliable visual inspection of a job well done. It is valuable for avoiding undercuring in large tanks and tank cars due to uneven heat application.

Details on these Unichrome Linings are given in Bulletin Chem-C-2. Contact Metal & Thermit also for names of nearest applicators of Unichrome Series B-124 Linings.

Reports show Unichrome Plastisols give record service

Unichrome Plastisols, which produce thick vinyl coatings, are withstanding conditions that rapidly deteriorate unprotected metals or other materials. To illustrate:

Plastisol coated ducts exhausting strong acid fumes show no deterioration after 4 years.

After 6 months service, plastisol coated agitators for chemical mixers show absolutely no wear. Rubber coatings, used previously, started to fail after only one month.

Plastisol coating on a 5-ft. bubble tray at bottom of a 60-ft. scrubbing tower has been withstanding acid fumes and caustic solutions for over 2 years now.

A report shows Unichrome Plastisol Coating on racks withstood 6 years of daily use in corrosive plating and cleaning solutions.

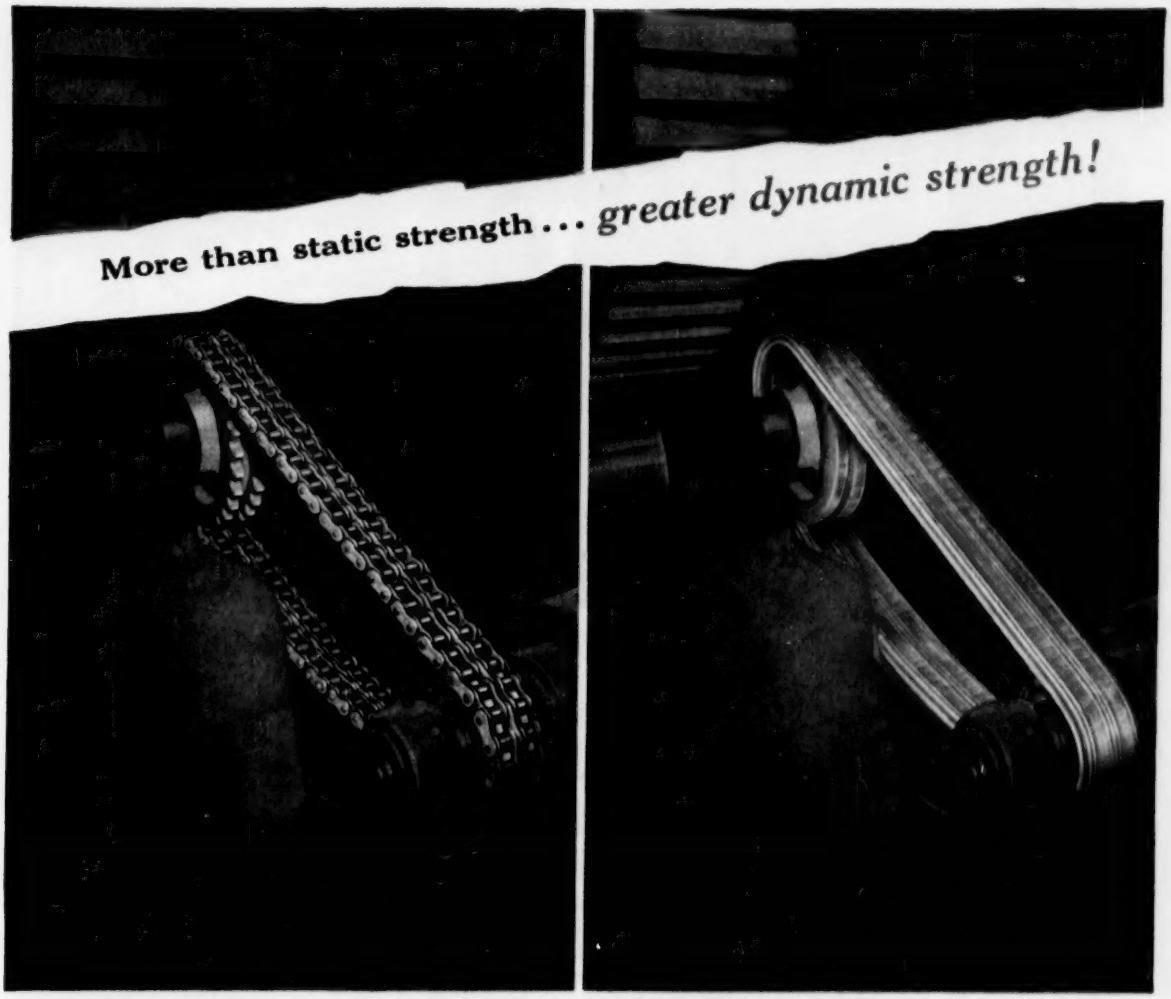
APPLICATION NO PROBLEM

Unichrome "Super 5300" Coating spray-applies seamless films as thick as sheet linings. It delivers up to 60 mils per coat. "Series 4000" Plastisols apply by dipping, slushing, troweling or other convenient means. Send for Bulletin VP-2 or name of the nearest applicator of Unichrome Plastisols.

Unichrome is a trademark of Metal & Thermit Corp.

METAL & THERMIT
CORPORATION

General Offices: Rahway, New Jersey
Pittsburgh • Atlanta • Detroit
East Chicago • Los Angeles
In Canada: Metal & Thermit—United Chromium of Canada, Limited, Rexdale, Ont.



RESISTANCE TO TENSILE STRESS is achieved with properly heat-treated, accurately machined side bars made of premium steel and fitted with properly hardened pins, bushings, rollers.

STRENGTH OF CHAIN IN MOTION results from such refinements as pitch-hole preparation, micro-finish of parts, special processing of side bars, pre-lubrication, rigid quality control from materials selection to final boxing.

Big reason for the extra life from LINK-BELT roller chain

STARTING shock, heavy loads and impact of sprocket engagement on modern heavy-duty machinery requires a chain that will resist fatigue. That's why Link-Belt gives you *greater dynamic strength* to shrug off stresses. Pre-stressing, closer heat-treat control, lock-type bushings, shot-peened rollers—all these Link-Belt refinements contribute extra stamina for extra life . . . provide smoother, more efficient chain performance . . . reduce drive and conveying costs.

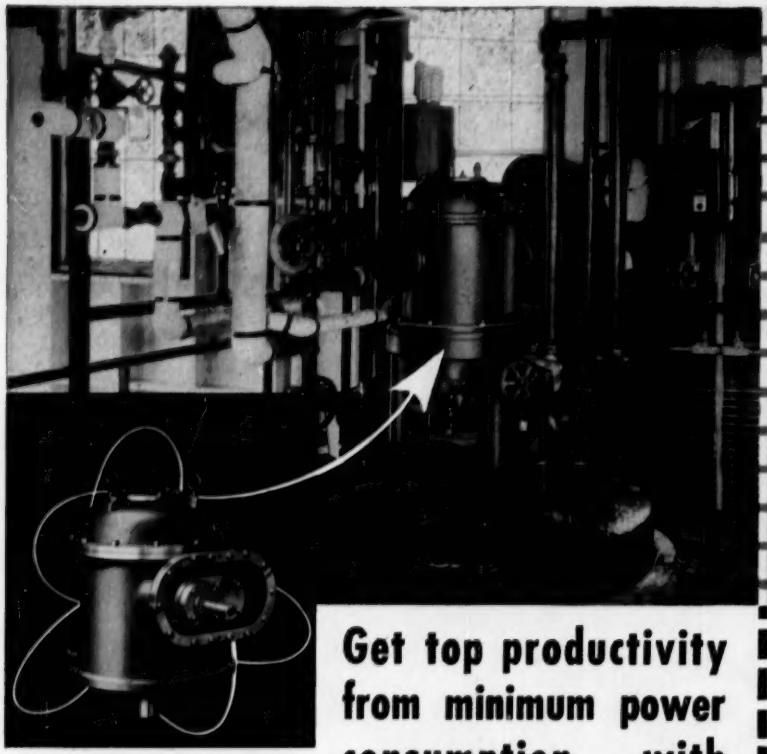
You have a choice of single- or double-pitch, single- or multiple-width chain. See your Link-Belt office or authorized stock-carrying distributor for facts.

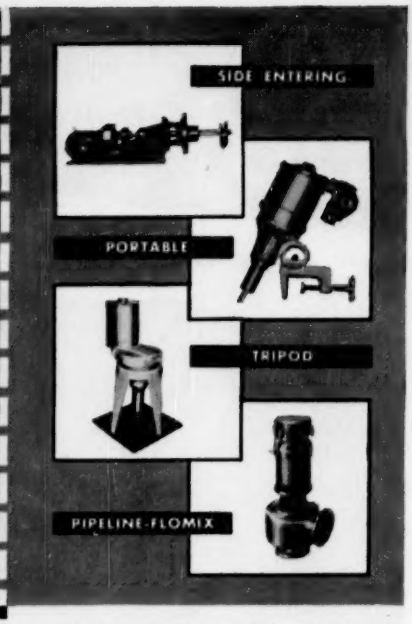
LINK-BELT

ROLLER CHAIN & SPROCKETS

14.644

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.





Get top productivity from minimum power consumption . . . with NETTCO "Engineered" Agitation!!

The agitator should suit the application . . . or unsatisfactory agitation, high power costs, and excessive maintenance may result. Exact process specifications can be met by providing the right combination of motor, drive, shaft, and stirrer. Nettco's ability to provide these standardized components . . . in the right size, the right speed, the right horsepower, etc. . . . mean savings and dependable, uninterrupted service to you. Check the design features of the Model T agitator line, and see what over fifty years experience . . . in producing the most complete agitator line available . . . offers you.

- **Minimum moving parts in compact, fully enclosed housing**
- **Interchangeable ratios from 6.25:1 to 100:1**
- **Dust, fume, and moisture-proof.**
- **Complete range of speeds**
- **Anti-friction bearings throughout, quiet operation**
- **Splash lubrication — oil trapped against leakage**
- **Large diameter "stepped" vertical shaft**
- **Widely spaced, oversized Timken bearings**

Model WT units, featuring worm gear reduction drives, offer ratios from 3.5:1 to 68:1 — plus many modifications to suit application needs. Send your process specifications to NETTCO agitation engineers for recommendations . . . Request Bulletin 551 and data sheet from **New England Tank & Tower Co., 87 Tileston St., Everett 49, Mass.**

ENGINEERED AGITATION

SIDE ENTERING

Standard NETTCO units available in 1/3 to 30 HP sizes — offering a variety of speed reduction designs, motor mounts, stuffing box modifications, etc., in alloys to suit process conditions. Bulletin No. 532.

PORTABLE & TRIPOD

For portable, open tank, or closed tank installations . . . in 1/6 to 2 HP sizes . . . with Standard NEMA vertical C flange motors. Feature DRIP-PROOF construction . . . in both high speed and medium speed designs.

PIPELINE-FLOMIX®

Exclusive NETTCO design for continuous pipeline mixing, increased product uniformity, simplified piping layouts, etc. Suitable for high capacities, pressures, and temperatures. Request Bulletin No. 531 for complete data.

NETTCO
ENGINEERED AGITATION SPECIALISTS

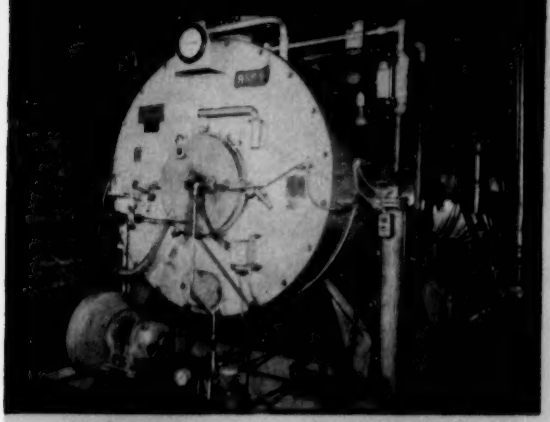


FREE LITERATURE

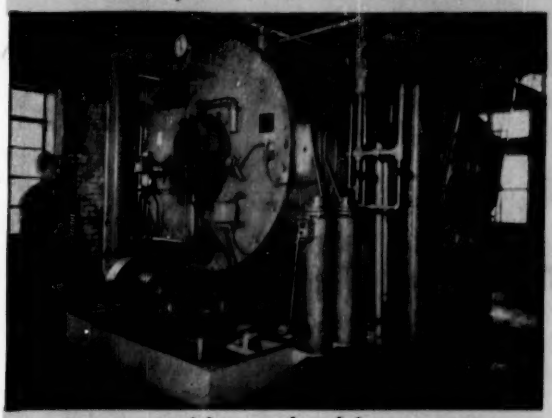
Please send me the following literature:

- ☐ **Tank Top Agitators—Bulletin 551**
- ☐ **Portable & Tripod Mixers—Spec. Sheets**
- ☐ **Pipeline-Flomix®—Bulletin 531**
- ☐ **Side Entering—Bulletin 532**

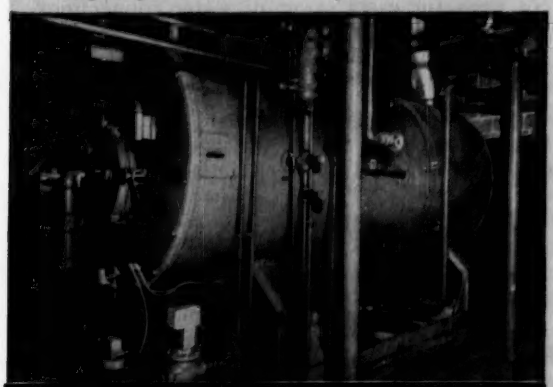
STEAM GENERATING PROBLEMS SOLVED . . . a report by AMESTEAM GENERATOR



Food processing steam requirements from lowest demand days to full capacity easily handled by this AMESTEAM GENERATOR.



Space problem solved by compact AMESTEAM GENERATORS dependably serving large Pure Food Factory.



Space-saving, efficient AMESTEAM GENERATOR delivering dependable steam for Gates Rubber Company.

". . . most economical and trouble-free unit we have owned in our thirty years", writes J. J. Giammalvo about his AMESTEAM GENERATOR.

"...the boiler operates with a minimum of maintenance beyond opening and cleaning for annual inspection. It easily handles our steam requirements from the lowest demand days to full rating when our dryers and condensers are being used to capacity, operating faithfully, week after week, burning No. 6 fuel oil.

"This boiler, installed on January 5, 1951, has been by far the most economical and trouble-free unit we have owned in the thirty years we have been engaged in the manufacture of cheese and other dairy products . . ."

Food plant appreciates space savings, performance and service.

"Up to the time we purchased your AMESTEAM GENERATORS, we were users of coal", writes Erwin C. Meyer of "HANSA" Pure Food Factory, Mamaroneck, N.Y. "We needed new boilers, so the writer studied different makes of steam generators and finally decided on your generator because it was so compact and complete.

". . . the new AMESTEAM GENERATORS are in their new boiler house and we are well pleased with their performance. We require very little service from you. The service you rendered was prompt and very cordial. It was a pleasure and it is a pleasure to do business with your firm."

At Gates Rubber Company—"very reliable and entirely satisfactory".

Robert L. Hall of Gates Rubber Company Sales Division, Inc., reports on the AMESTEAM GENERATOR in the firm's Sioux City, Iowa plant:

"We have found this equipment to be very reliable and entirely satisfactory in our application. The boiler has carried the maximum load that we have required of it and we have absolutely no mechanical or electrical difficulties since its installation" (May, 1956).

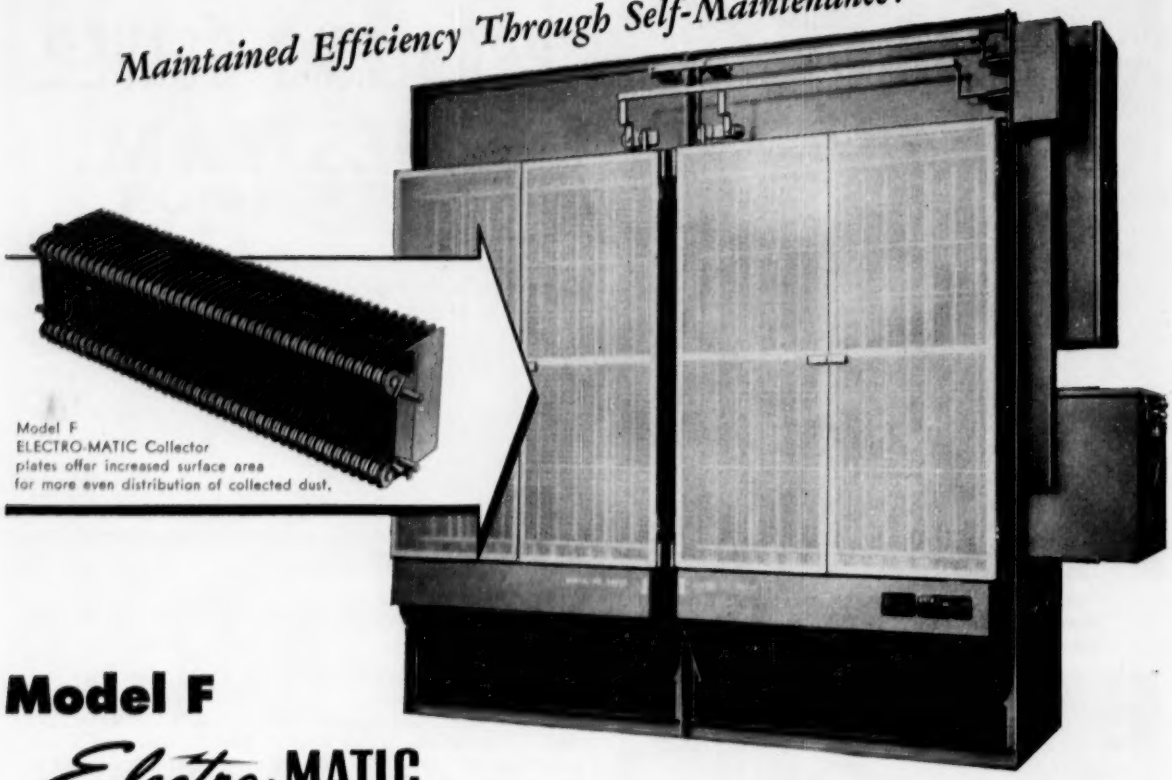
". . . we had occasion recently to inspect the boiler internally, and it was found to be in excellent condition in every respect".

WHAT'S YOUR STEAM PROBLEM?

If you need 10 to 600 HP and want the kind of space-saving, trouble-free service enjoyed by these owners of AMESTEAM GENERATORS, write today for our catalog and the name of your nearby AMESTEAM dealer.

AMES IRON WORKS INC.
BOX S-97 OSWEGO, N.Y.

Maintained Efficiency Through Self-Maintenance!



Model F
ELECTRO-MATIC Collector
plates offer increased surface area
for more even distribution of collected dust.

Model F Electro-MATIC Delivers Uniformly Clean Air, Continuously, Around the Clock

WANT a continuity of clean air that won't vary in quality from one day, month or year to another? It's yours with the Model F ELECTRO-MATIC—the new electronic precipitator whose continuous high efficiency is assured through constant self-cleaning.

The cleaning efficiency of the Model F ELECTRO-MATIC extends over a wide range of particle sizes, from smoke to largest air-borne materials. Its "capacity for work" is increased, too. Newly designed collector plates increase surface area 53% to further reduce possibility of dust build-up and, at the same time, slows down air velocity between plates by 25%.

But here's the payoff! Unlike most other filters, ELECTRO-MATIC's efficiency can't taper off due to the accumulation of dust. Continuous self-cleaning action keeps collector plates in constant fighting trim. There's no time out for washing down with hot water. No need for extra sewer or water connections. ELECTRO-MATIC maintains its own rigid housekeeping schedule without regard to clock or calendar.

Yes, if performance is the payoff, the Model F ELECTRO-MATIC is definitely today's finest electronic filter. For complete product information, call your local American Air Filter representative, or write for Bulletin 250.

AAF
herman nelson

American Air Filter
COMPANY, INC.
326 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF Dust Control Equipment





Illinois Steam Heating Specialties

BETTER AIR IS OUR BUSINESS

Herman Nelson Unit Heaters





Herman Nelson Unit Ventilators



EXON 480... specifically for (tone perfect) phonograph records

typical of the Pin-Pointed Qualities in Exon Vinyl resins

These "biscuits" are compounded of Exon 480, the vinyl resin created specifically for phonograph records. With each, you get a finished recording of high tonal quality and breakage resistance.

Exon 480 combines many production advantages in the blending, fusing, preforming and molding processes. For instance, here's one production economy: Exon 480's higher bulking density speeds banbury output as much as 25%.

You also get high thermoplasticity, good heat and light stability, plus compatibility with the vinyl plasticizers, stabilizers and pigments most often used. No wonder so many record makers specify Exon 480 for better "biscuits" every time. Another example of how Exon's Pin-Pointed Properties match your particular needs.

Exon 480 is just one of the many fine resins in industry's most complete line of versatile vinyls. It is another reason why industry looks to Firestone Exon for engineered answers to its needs.

Consider your own production or product problem. Then, for resin properties pin-pointed to the best answer for you, check with Firestone.

Firestone EXON RESINS

For complete information and technical service, call or write:

CHEMICAL SALES DIVISION: FIRESTONE PLASTICS COMPANY

DEPT. 726L, POTTSTOWN, PA. • A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

IN CANADA, CONTACT CHEMICAL SALES DIVISION, FIRESTONE TIRE AND RUBBER COMPANY OF CANADA LTD., HAMILTON, ONT.

INDUSTRY'S MOST COMPLETE LINE OF VINYLS ENGINEERED TO YOUR SPECIFIC NEEDS



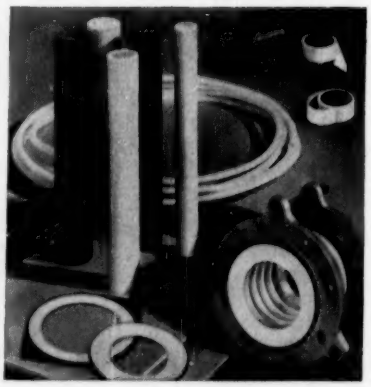
For extremes of corrosion and temperature specify R/M FLEXIBLE THIN-WALL Teflon* HOSE

Hundreds of applications prove that in critical fluid services nothing does the job like R/M Flexible Thin-Wall "Teflon" Hose. It is completely impervious to all known industrial acids, caustics and solvents. It is noncontaminating, has zero water absorption, and its unique slippery surface resists adhesion to most materials, reduces pressure drop to a minimum. Designed for continuous service from −100° to +400°F and under pressures up to 1500 psi.

R/M "Teflon" Hose is produced in a wide range of inside diameters and wall thicknesses and in both wire-braided and rubber-covered forms. Write us for Bulletin 6700 and feel free to call on us for help in solving your hose problems.

Other R/M "Teflon" products for the chemical industry include rods, sheets, tubes and tape; centerless ground rods held to very close tolerances; bondable sheets and tape; stress-relieved molded rods and tubes; mechanical packings and gaskets; expansion joints and flexible couplings; Raylon—R/M trade name for mechanical grade "Teflon"—having many characteristics of virgin "Teflon."

* A Du Pont trademark



R/M

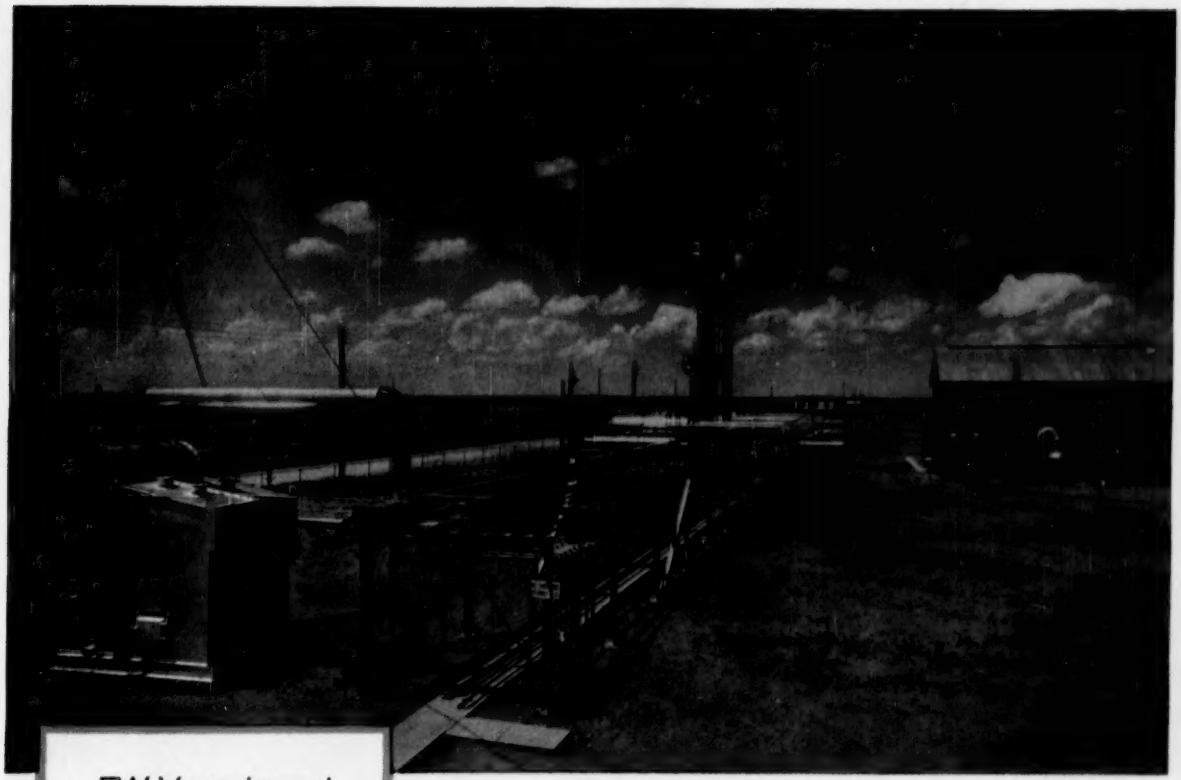
RAYBESTOS-MANHATTAN, INC.

PLASTIC PRODUCTS DIVISION, MANHEIM, PA.

FACTORIES: Manheim, Pa.; Paramount, Calif.; Bridgeport, Conn.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Engineered Plastics • Asbestos Textiles • Mechanical Packings • Industrial Rubber • Sintered Metal Products • Rubber Covered Equipment Abrasive and Diamond Wheels • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Industrial Adhesives • Bowling Balls

Where dependability is at a premium...



FW Vaporizer at AUTOMATED Gasoline Plant gives trouble-free operation in virtually unattended service

At the Ropes Field Plant, operated by Honolulu Oil Corp., slightly less than 2000 MCF of gas per day were available for processing – hence capital expenditure and operating costs for this isolated gasoline plant had to be kept to an absolute minimum. Process heating is provided by a FW vaporizer using Para-Cymene which operates at only 380 F, 8 psig! Designed for maximum automation and a minimum operating force, the Ropes installation has fully lived up to the owners' expectations for dependability and economy of operation.

high-temperature, low-pressure units HEAT-ENGINEERED by FW prevent outages – cut maintenance

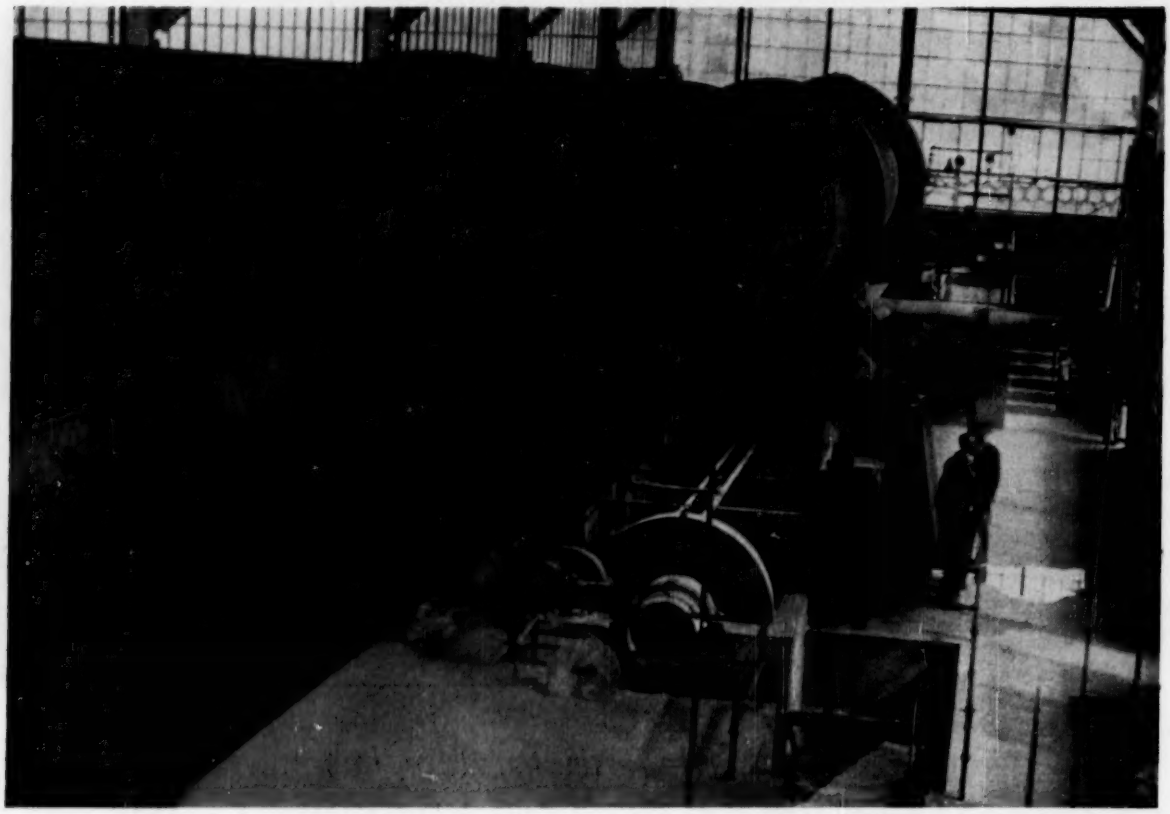
OVER a period of 23 years, Foster Wheeler engineers have recognized that an *entire process system* should be analyzed before recommending the proper high-temperature, low-pressure vaporizer. This application engineering "beyond the vapor outlet" assures a vaporizer that's *right* for the job – perfectly matched to a heating system with the most efficient and dependable piping arrangements, circulation method and thermal design.

Another advantage is that only Foster Wheeler does the *complete job* – designs and builds the vaporizer, installs it in your plant, puts it "on stream", and follows through with checkups and service to assure continued top performance under changing conditions of operation. For further information, send for Bulletin ID-54-5. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

FOSTER FW WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

HAVE YOUR NEXT ROTARY KILN
DESIGNED COMPLETELY . . .
COMPLETELY BUILT



BY VULCAN . . . *THE COMPANY WITH THE "NEW LOOK"*

Illustrated above is a VULCAN Rotary Kiln 8′x160′ long, used for calcining of material needed in the manufacture of abrasives. This all-welded kiln, together with a partially submerged and water-sprayed 5′x40′ Cooler under the kiln, was designed and built completely at VULCAN's plant in Wilkes-Barre, Pa.

Since its installation in 1944, this unit has never had any downtime, and is still in perfect condition.

If you have need for a Rotary Kiln, call in VULCAN of Wilkes-Barre, the Company with the "New Look". VULCAN designs, engineers, and manufactures kilns for: (1) cement (wet or dry); (2) coke; (3) lime; (4) calcined dolomite; (5) pigments; (6) nodulizing, agglomerating and sintering, plus kilns for many other related chemical and metallurgical processes.

There's a "New Look" at VULCAN: recent installation of new machinery and equipment—an investment of over a quarter million dollars—top-flight engineers employing the latest engineering practices; fabrication by skilled craftsmen; the most modern-day business concepts. Every department is co-ordinated, so you get quick action from your inquiries in the beginning—to fast deliveries at the end.

Write or call today. Let us design and build your kiln. Enjoy years of trouble-free, dependable operation.

Any information on items listed below will be sent to you immediately:

- Rotary Kilns, Coolers and Dryers
- Rotary Retorts, Calciners, Etc.
- Automatic Quick-Lime Hydrators
- Vertical Lime Kilns
- Briquetting Equipment
- Cast-Steel Sheaves and Gears
- Steel Plate Fabrications

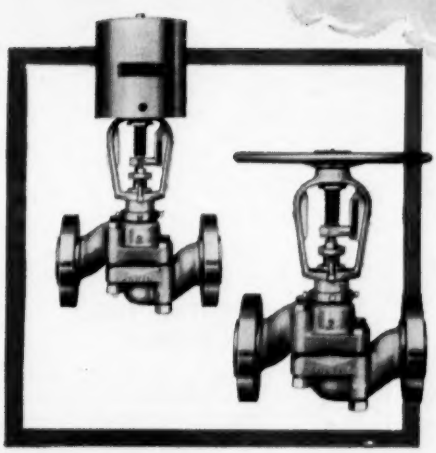
VULCAN IRON WORKS

WILKES-BARRE, PA., U.S.A. CABLE ADDRESS "VULWORKS WILKESBARRE" ESTABLISHED 1849

TOP HAND

...where Management
...Production and
Maintenance
are concerned!





ANNIN VALVES *meet every test of reliability, response and easy maintenance at low cost*

ANNIN VALVES are the only valves that meet the rigorous requirements of the missile program and the exacting demands of the modern process industries in a single standard construction at no premium.

- **MANAGEMENT** prefers Annin Valves because of low initial cost and low maintenance and spare parts inventory.
- **PRODUCTION** men prefer Annin Valves because of longer on-stream service and better product control.
- **MAINTENANCE** men prefer Annin Valves because of ease of maintenance and simplicity of modification for other services.

ANNIN *Control* **VALVES**

THE ANNIN COMPANY
DIVISION OF THE ANNIN CORPORATION
6570 Telegraph Road, Los Angeles 22, California

HERE IT IS!

NMR



ANALYZER

Accurate moisture tests IN SECONDS...not hours ...with Schlumberger NMR Analyzer

H_2O measured through nuclear resonance of Hydrogen content . . . normal readings in ½ minute; accurate to .1%!

The new Schlumberger *Nuclear Magnetic Resonance* (NMR) Analyzer, uses principles of nuclear physics to measure the total H_2O (moisture) content of the material being tested . . . with speed and accuracy that present accepted methods can not approach.

Using the NMR Analyzer is remarkably swift and simple. The sample of material, enclosed "as is" in a sealed bottle, is placed in the test chamber and the scanning current switched on. The actual measurement is entirely automatic—the recording of the moisture content is inscribed on the moving chart that forms a permanent record.

The Schlumberger Analyzer is virtually foolproof after being set up. Tests are made simply by placing the sample in the testing receptacle and snapping on the scan switch. Thirty seconds is the normal recording time, although in some instances longer periods are required —never exceeding four minutes.

Its effectiveness has been proved through field use on materials such as starch, paper pulp, grain, candies, syrups, cotton, etc.

If you would like to learn how the NMR Analyzer will perform on *your* materials, we will be glad to run NMR tests on your samples. Please write for information on the preparation and packing of your samples. For technical data on the NMR Analyzer, address *Applications Group, Room 500, Schlumberger Well Surveying Corporation, Ridgefield, Connecticut.*

SEE IT AT THE ISA SHOW

Come to Booth 211 at the ISA Convention and see the new, spectacular NMR Analyzer read off moisture content of samples in just a fraction of a minute.

NMR Specialists will be in attendance to explain this new, nondestructive analysis and answer your questions.

SCHLUMBERGER

WELL SURVEYING CORPORATION

for durable, chemical-proof floors . . .

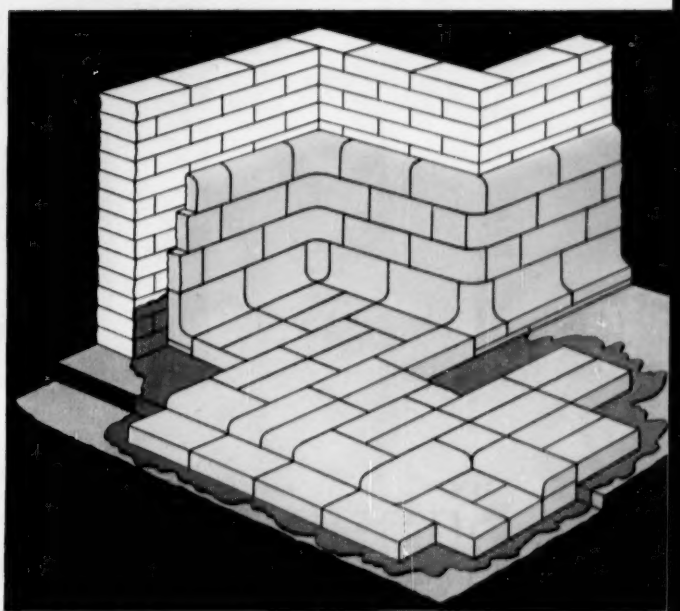
HARBISON-WALKER

DURO ACID-PROOF TILE

Duro tile are dense and non-absorbent throughout their entire thickness and are not dependent upon a skin glaze for resistance to penetration by corrosive liquids. The smooth, non-glassy surface of Duro is good for traction and the avoidance of slippage. Surfaces can be textured if desired.

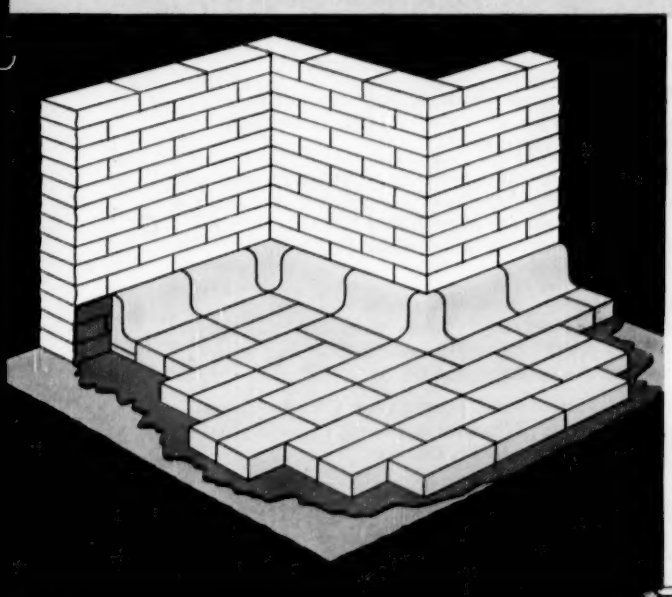
Duro is vitreous to the most desirable degree for high strength to withstand impact and abrasion and for maximum impermeability and resistance to chemical action. This combination of properties is attributable to its stabilized chemical composition of aluminum silicate which is exceedingly low in the more soluble basic fluxes, such as iron oxide and alkalies, the vacuum method of forming and the high temperature at which it is fired. Its mineral constituents are converted to the most stable forms of greatest insolubility in acids and various corrosive materials.

The light buff color of Duro, with freedom from the glare caused by glazed surfaces, contributes to the clean, sanitary appearance of the floors. The excellent workmanship of Duro tile and the variety of cove base shapes makes readily feasible a neat close fitting construction that is easy to keep clean.



SHAPES AND SIZES Depicted here are typical designs of DURO floor tile constructions using Harbison-Walker shapes and standard rectangular sizes as shown.

9" x 4½" x 1¼" ST
9" x 4½" x 1½" ST
9" x 4½" x 2" ST
9" x 4½" x 2½" ST
9" x 4½" x 3" ST
12" x 6" x 1½" ST



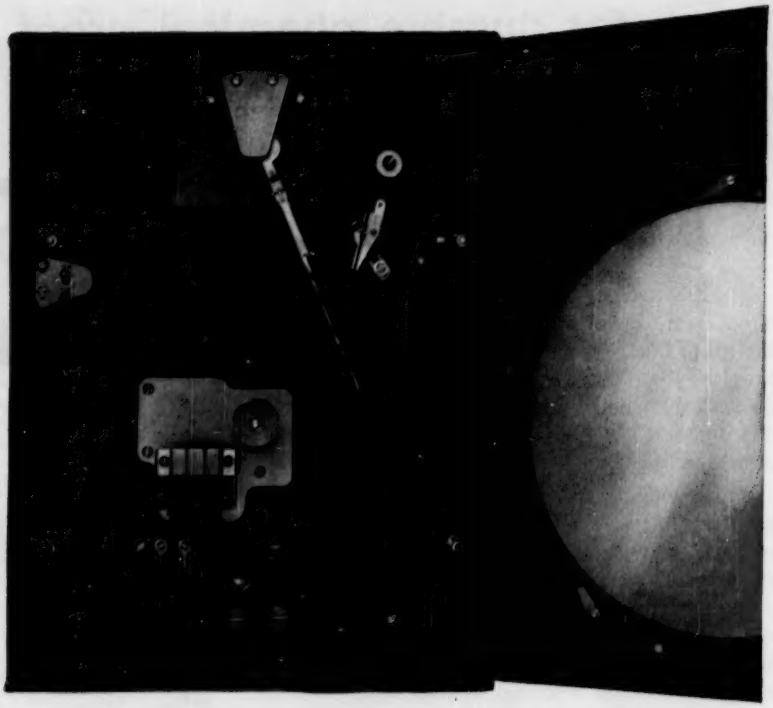
Typical applications for Duro floors

Acid Rooms
Bakeries
Bottling Plants
Breweries
Chemical Plants
Dairies
Die Works
Electroplating Plants
Electrolytic Metal Refineries
Food Processing Plants
Galvanizing Departments
Meat Packing Plants
Metal Fabricating Plants
Paper Mills
Photoengraving Plants
Rayon Plants
Steel Pickling Plants
Textile Mills

Write for descriptive bulletin

World's Most Complete Refractories Service

HARBISON-WALKER REFRACTORIES COMPANY
AND SUBSIDIARIES
GENERAL OFFICES: PITTSBURGH 22, PENNA.



Simplicity...

you'll find it in Brown Pressure Gages and Thermometers

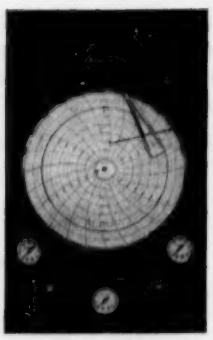
Clean, simple design—simplicity that minimizes operating or maintenance difficulties—sets Brown Pressure Gages and Thermometers apart. These rugged instruments use direct, simple linkages . . . very few parts. Basic components for both thermometers and pressure gages are interchangeable, and cases are identical.

The many narrow spans available, together with the large charts and scales, give you full use of the high accuracy of these instruments.

Brown Pressure Gages are available in many ranges, with a minimum of absolute zero and a maximum of 4,000 psi. Brown Thermometers are particularly suitable for the intermediate temperature range, extending from —125 to 1000 F.

Your nearby Honeywell sales engineer will gladly give you complete details on these instruments as they relate to your particular requirements. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

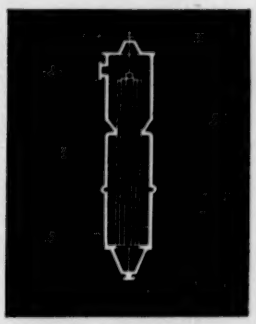


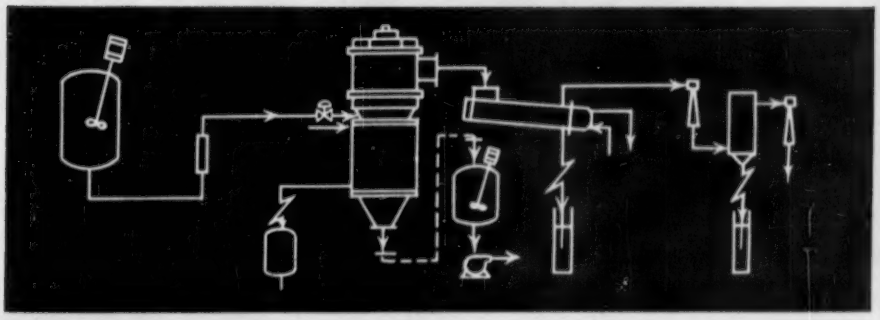
Simplicity . . . Versatility, Too

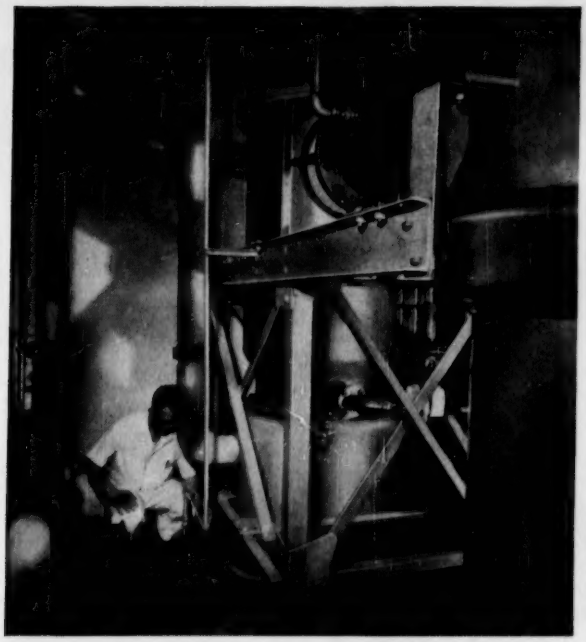
A wide variety of models, ranges and accessories are available for exact matching of Brown Pressure Gages and Thermometers to your specific applications.

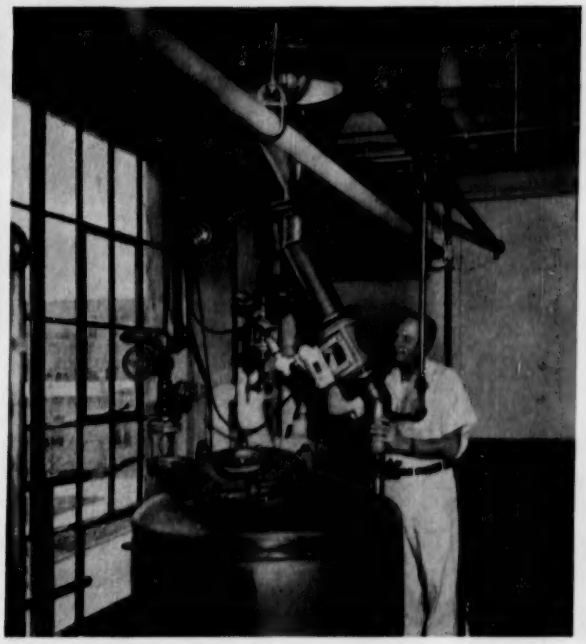
Honeywell

First in Controls









High Concentration of Heat-Sensitive Products with a Turba-Film Processor at E.R. Squibb & Sons

Twenty-four hours a day, seven days a week, a Turba-Film® Processor at the E. R. Squibb & Sons Division, Olin Mathieson Chemical Corp., accomplishes high concentration of heat-sensitive solutions without impairment of essential values. This is possible because of the mechanically aided turbulent, thin, falling film; and because of lower processing temperature, minimum hydrostatic head and extremely short residence time. Product quality is maintained by close control of feed-rate, heat input and operating pressure from a central point during the continuous, single-pass operation. After leaving the Turba-Film Processor the concentrate is crystallized as high-purity antibiotics.

Other advantages of the Turba-Film Processor are space-saving vertical design, and the fact that production can easily be switched from one product to another . . . several times a day if necessary.

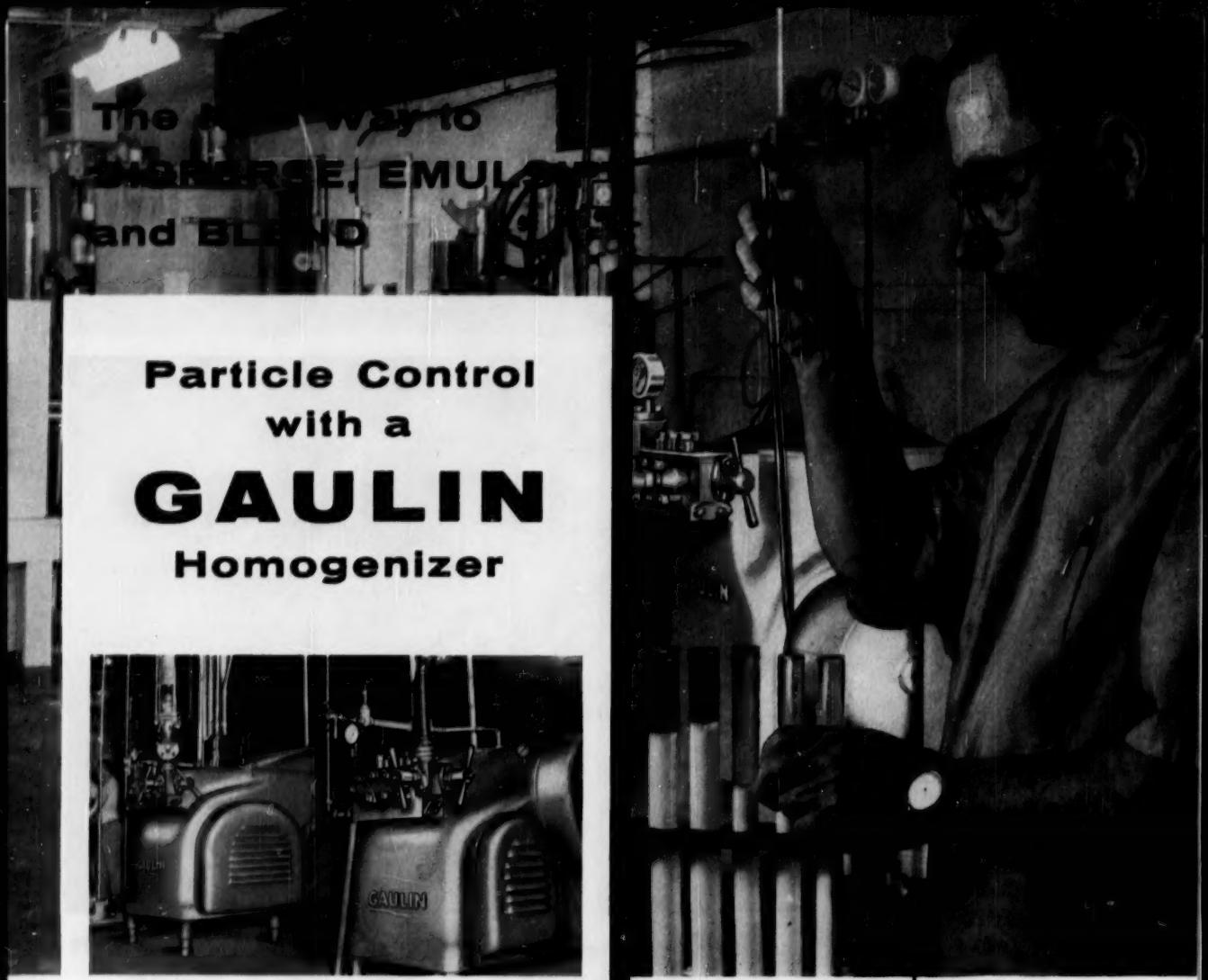
This versatile processing unit is performing equally well in many applications of heat and mass transfer operations involving vapor-liquid equilibria such as de-aeration, absorption, distillation, deodorization, countercurrent stripping, demonomerization of polymers and de-ammoniation of natural latex.

Rodney Hunt offers completely engineered package systems for the chemical, pharmaceutical and allied industries. Qualified engineers are available to discuss application of the Turba-Film Processor to your processing problems. Write for full information today.

RODNEY HUNT MACHINE CO.
Process Equipment Division
31 Vale Street, Orange, Massachusetts, U. S. A.

RODNEY HUNT®

SERVING THE CHEMICAL AND PROCESSING INDUSTRIES WITH EQUIPMENT AND ENGINEERING



Particle Control with a

GAULIN

Homogenizer

What's the best method to disperse, emulsify or blend? It's all in Particle Control. No single piece of equipment will satisfy all requirements, so Gaulin offers three designs.

HOMOGENIZER works at high pressures, uses tremendous velocity and energy gradients to create extreme concentrated turbulence to produce more uniform, stable emulsions and dispersions.

SUB-MICRON DISPERSER handles pigments and other abrasive dispersions. S-M-D Valve uses the same hydrokinetic principles as Homogenizer to produce dispersions of ultimate fineness.

RE* COLLOID MILL is a highly advanced, two-stage design which provides continuous micrometer control for producing superior emulsions or dispersions. Operation is greatly simplified, maintenance negligible.

LABORATORY HOMOGENIZERS AND COLLOID MILLS are available on rental basis. Use them to explore the dramatic new Gaulin dimension of Particle Control.

PARTICLE CONTROL plus GTA — Gaulin Technical Assistance — is the key to new savings, better quality in your processing.



For complete data on the new RE* Colloid Mill — Ask for Bulletin C-57



Find out about all the things you can do with a Laboratory Homogenizer — Ask for Bulletin LH-55.



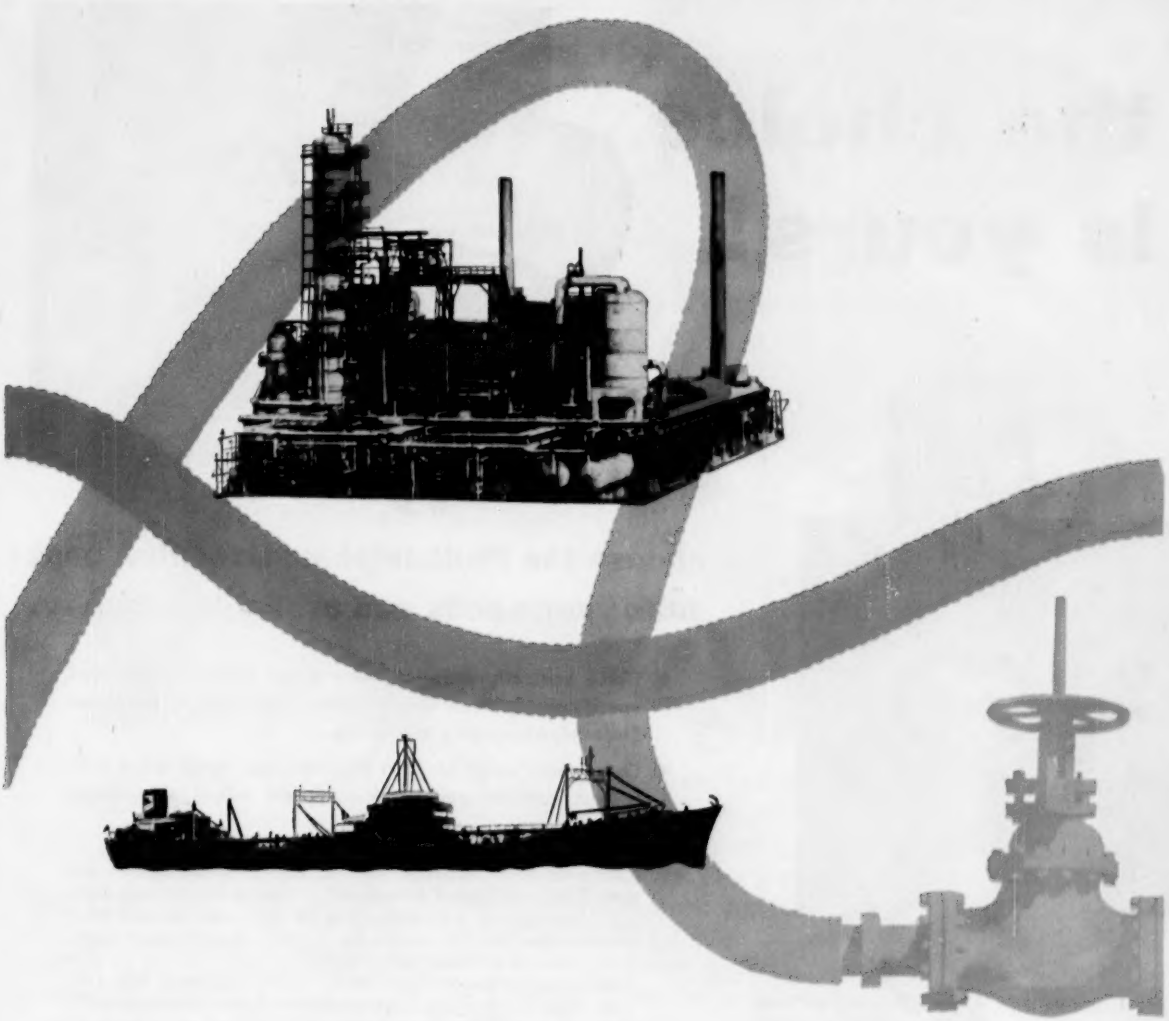
FREE! *Ask for GTA* and the Gaulin Library of Product Information . . . your best source for a low-cost solution to moving or mixing your product. Write or call today.

For technical data on Homogenizers and Sub-Micron Dispersers — Ask for Bulletins H-55 and SMD-55.

Manton-Gaulin offers complete research, laboratory and test facilities, plus 60 years' experience, to help you apply Particle Control for dispersions, emulsions and blends.

MANTON Gaulin

MANTON-GAULIN MANUFACTURING COMPANY
71 Gardon St., Everett 49, Mass.



Sun Ship has furnished equipment for many major oil companies in America

Of essential importance to American welfare is the free, expanding progress of the Oil Industry. Tankers for many of the oil companies have been built in the Sun Ship Yard. Also, refining equipment repairs and replacements have been furnished for the major oil companies.

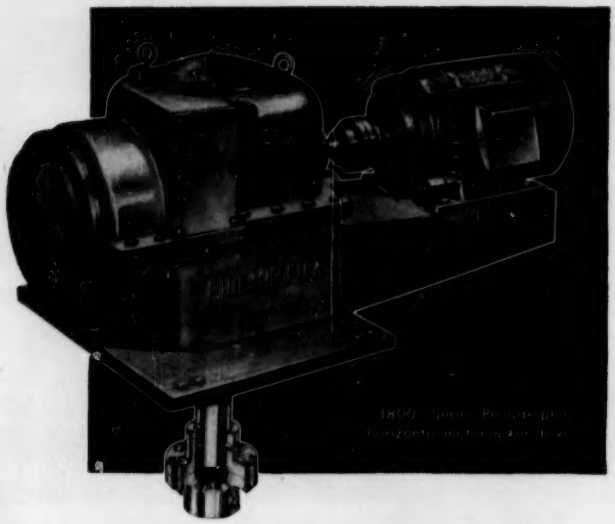
In addition, Sun builds special machinery and fabricated steel products for a variety of other industries whose problems have been a welcome challenge—readily accepted—easily solved. Call or write our Sales Engineering Department about your plans—or problems. Immediate, courteous attention is assured.

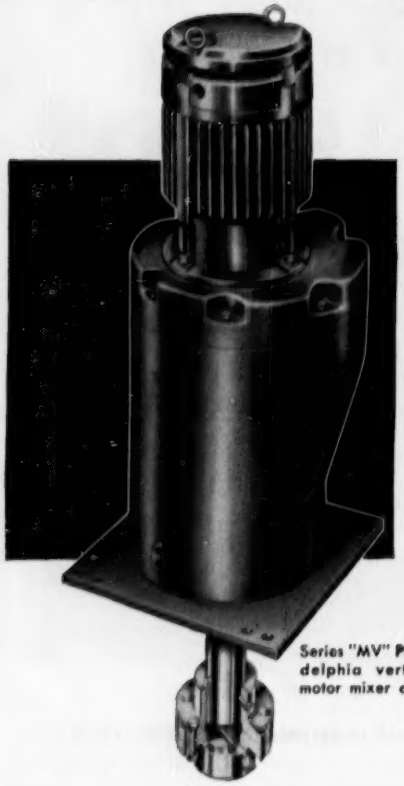
Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE (SINCE 1916) CHESTER, PA.

the choice is yours!





Series "MV" Philadelphia vertical motor mixer drive

choose the Philadelphia Mixer that best suits your needs and available space . . .

- **These basically different drive types are both designed specifically for fluid mixer service, both built to the same Philadelphia quality standards.**
- **Companion sizes of each Philadelphia Mixer drive type mount interchangeably in complete mixer assemblies.**

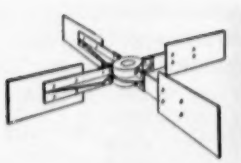
"3800" SERIES

Compact and versatile "3800" Series mixer drives are specifically designed to minimize headroom requirements . . . maximize durability, flexibility, and trouble-free service life. Readily accessible helical change gears facilitate changes of mixer shaft speeds to suit varying process conditions. The Series "3800" drive utilizes standard foot-mounted motors. Highest drive efficiencies are possible through use of precision spiral bevel-helical gear arrangement. Designed for the more difficult fluid mixer applications, Philadelphia "3800" Series drives are equipped with heavy duty precision roller bearings spaced with maximum span for extreme stability of all shafts and long service life.

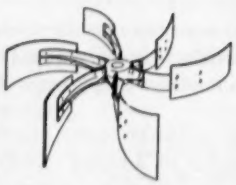
"MV" SERIES

As a companion line to the "3800" Series, Philadelphia "MV" Series vertical motor mixer drives offer straight-through shaft arrangement, with motor and gear reducer vertically in-line. Utilizing either flange or foot-mounted motors, Philadelphia "MV" Series drives are completely interchangeable with "3800" Series units for use in complete mixer drive assemblies mounting on open or closed tanks. Here is a unit that meets industry demands for an inexpensive, heavy duty vertical shaft turbine mixer drive.

Choose the design that best suits your required process piping arrangement . . . or available space. Send for the new Philadelphia Mixers Catalog today.



Philadelphia versatile 4-blade, vertical flat blade turbine impeller.



Standard Philadelphia 6-blade, vertical curved blade turbine impeller.

philadelphia mixers

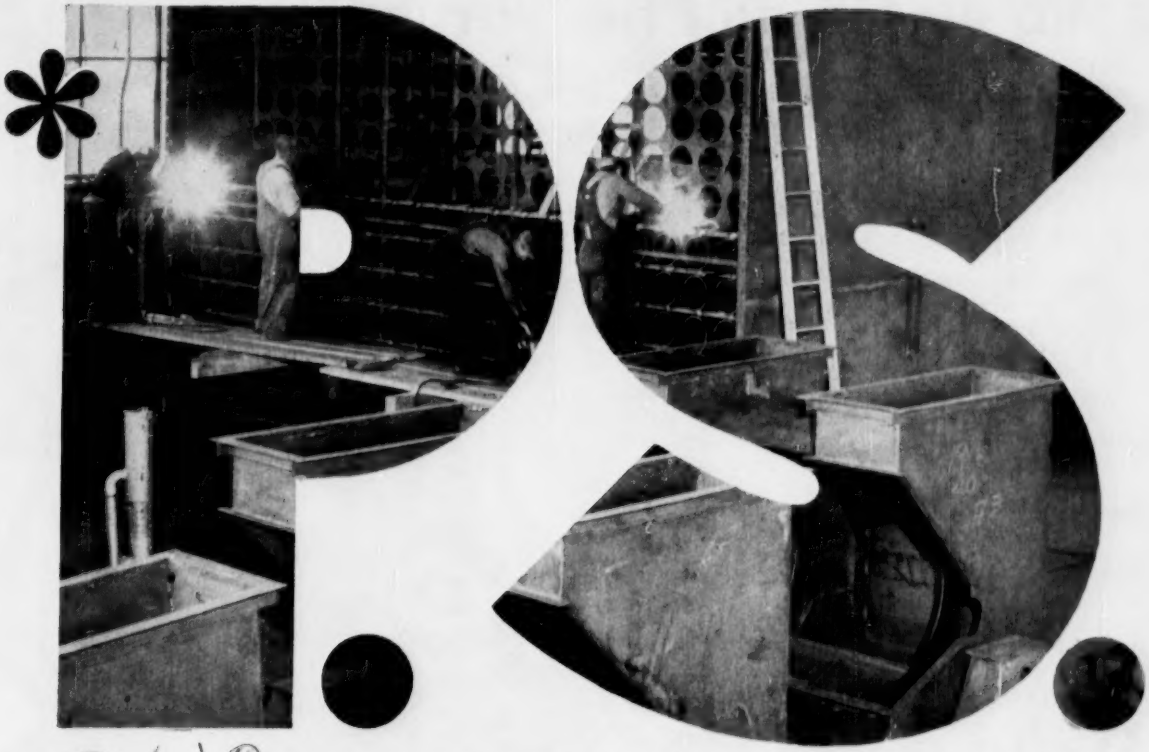
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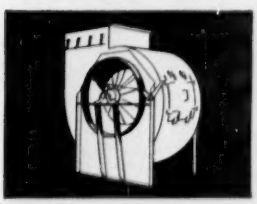
*PROBLEM SOLVERS

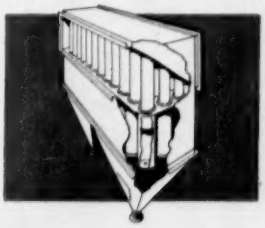
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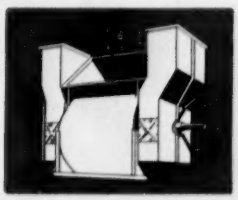
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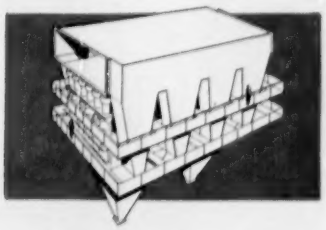
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Logic and sequencing control of two Springfield Machine Tool Co. form grinders is performed by CYPAK static control apparatus. CYPAK activates the solenoids of hydraulic valves controlling the grinder's feed cycle.

In machining the impeller housing of automatic transmissions, the operator places the workpiece in the chuck, presses the cycle button ... and CYPAK does the rest ... automatically.

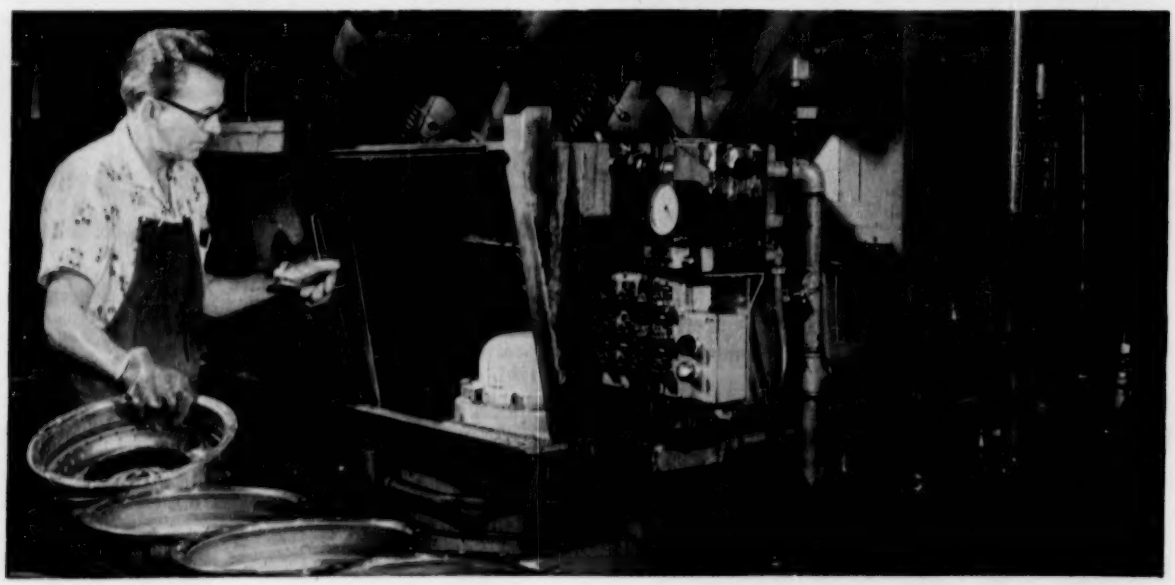
For complete information about CYPAK call your Westinghouse representative, or write Westinghouse Electric Corp., Dept. B, P.O. Box 868, Pittsburgh 30, Pa.

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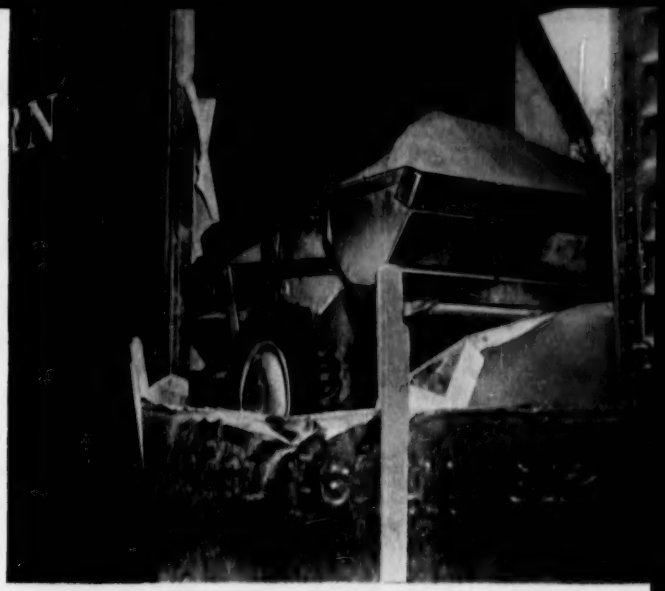
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WHEN ONE-HALF OF THE BOXCAR IS EMPTY... THE TL-6 TURNS AROUND INSIDE THE CAR AND UNLOADS THE OTHER HALF



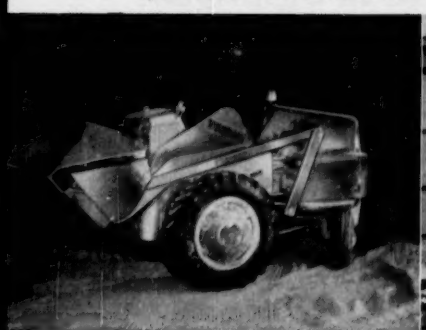
Compact TL-6 TRACTOLOADER® keeps material moving for CHENOA MILLING COMPANY, Chenoa, Illinois

Since there isn't a ramp at Chenoa Milling Company's warehouse (due to railroad restrictions), the TL-6 enters the boxcar containing grain about 200 yards away — where there is a ramp. Car is then moved to warehouse. Here a makeshift bin is fed by the TL-6 and the grain moves into the warehouse on a conveyor. The boxcar stays at the warehouse until it's completely unloaded — no need to move it back to the ramp when half unloaded. The TL-6, with its compact design and short turning radius, easily maneuvers around inside the car to finish its job.

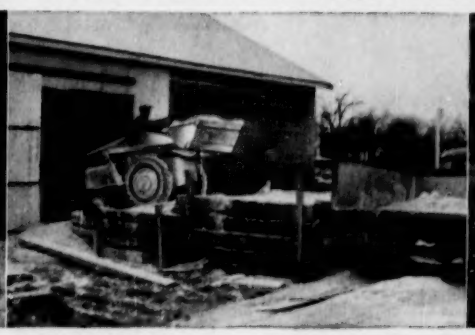
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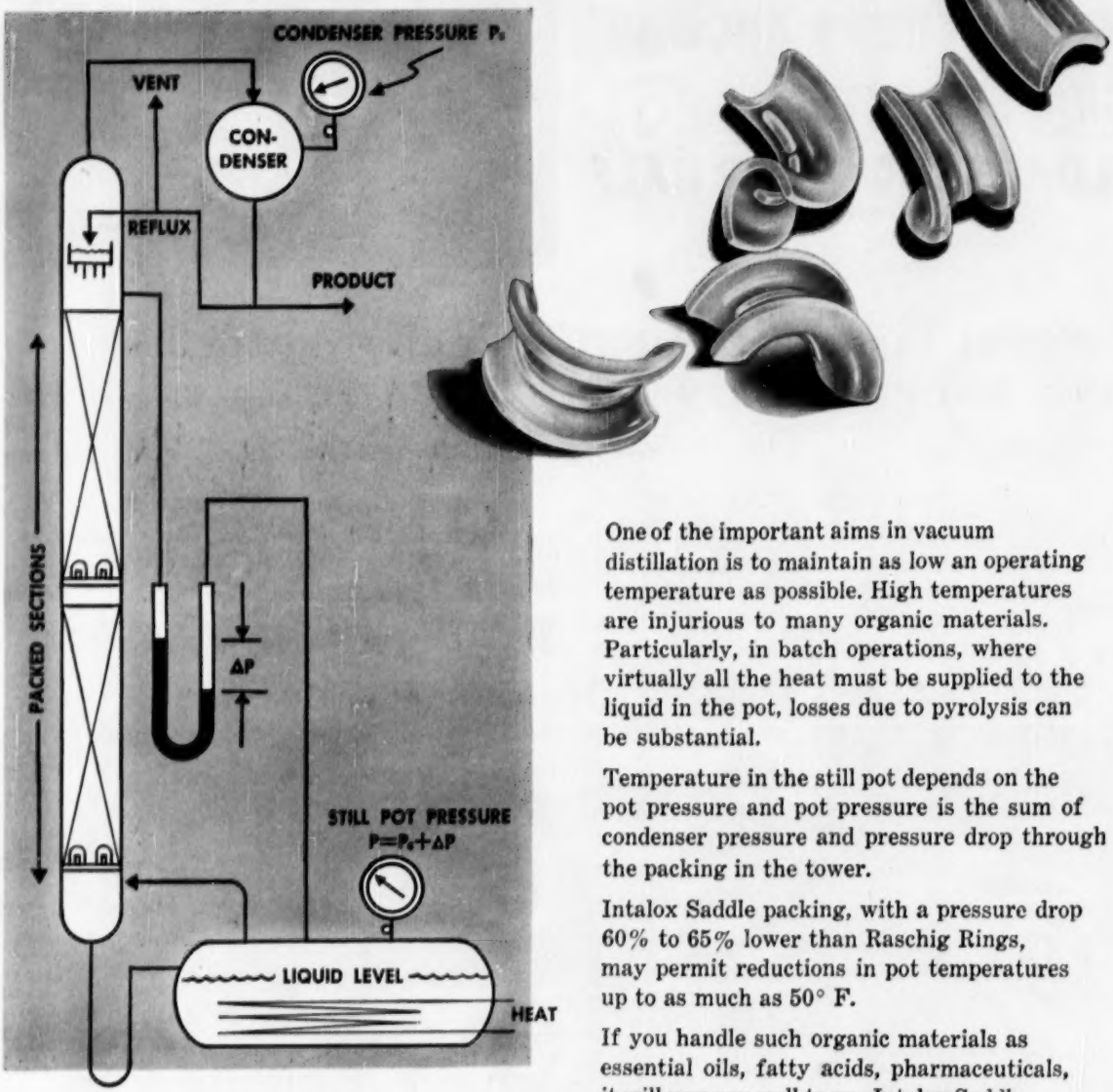
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☐ Send catalog on Tracto-Loaders

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How to Lower Pot Temperatures in

VACUUM DISTILLATION



One of the important aims in vacuum distillation is to maintain as low an operating temperature as possible. High temperatures are injurious to many organic materials. Particularly, in batch operations, where virtually all the heat must be supplied to the liquid in the pot, losses due to pyrolysis can be substantial.

Temperature in the still pot depends on the pot pressure and pot pressure is the sum of condenser pressure and pressure drop through the packing in the tower.

Intalox Saddle packing, with a pressure drop 60% to 65% lower than Raschig Rings, may permit reductions in pot temperatures up to as much as 50° F.

If you handle such organic materials as essential oils, fatty acids, pharmaceuticals, it will pay you well to use Intalox Saddle Packing in your distillation processes.

87F

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Chemical Engineering

Developments

SEPTEMBER 1957

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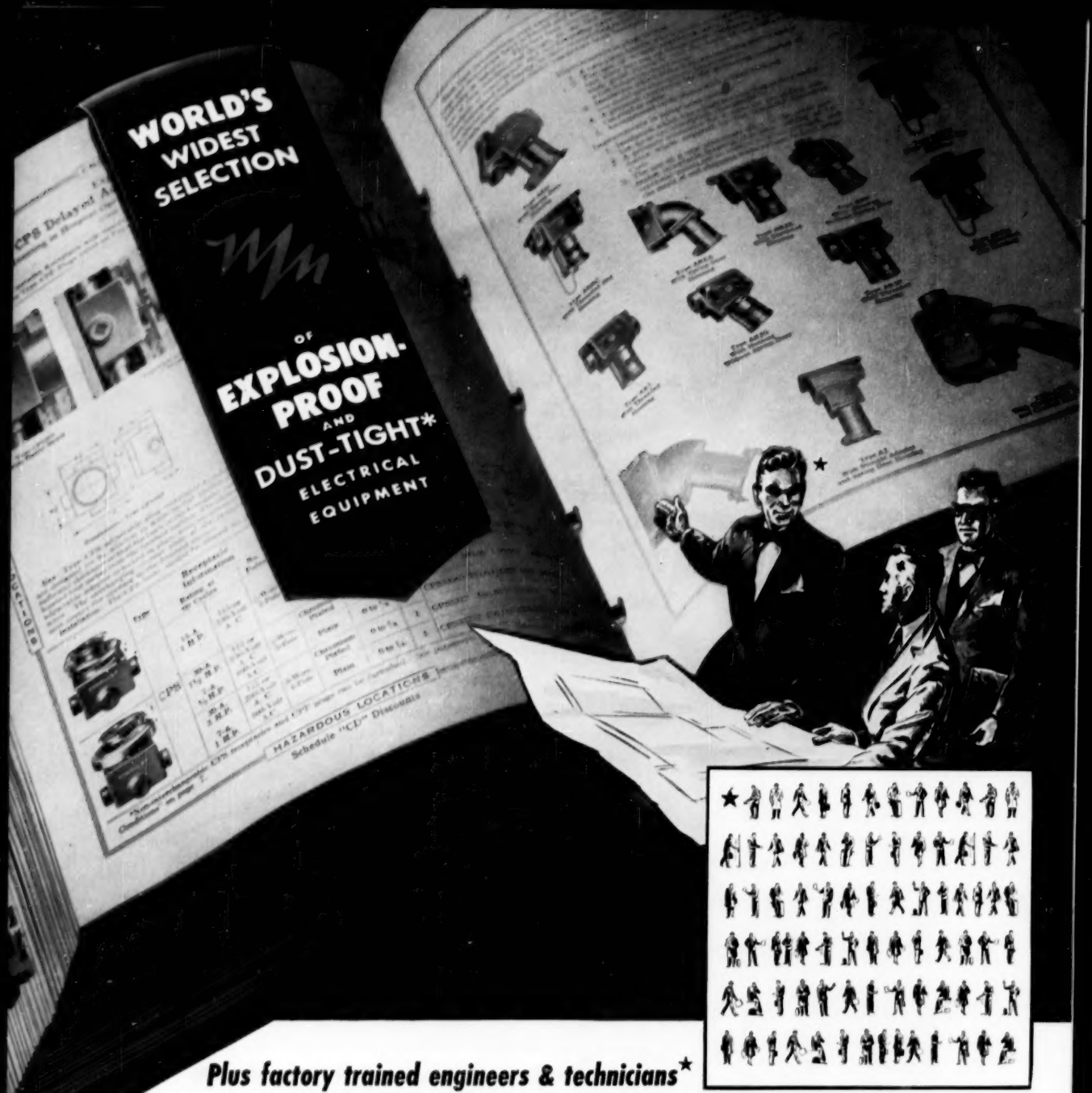
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Plus factory trained engineers & technicians★ to assist you in selecting the types best suited to your needs

There are more than 17,000 items in the Crouse-Hinds line of Condulet® and floodlighting equipment. Each is designed with some specific advantage or quality that makes it best suited for a particular application.

Of course, no engineer, electrician or contractor with a regular job to do, could possibly keep in mind all the pertinent data and information concerning each of these items. That's why Crouse-Hinds maintains a factory-trained field staff of 80 graduate E.E.'s and technical men.

Their job is to confer with the users of Crouse-Hinds equipment and to point out the reasons why certain Condulet equipment or floodlights are better suited for a particular job than others. With a broad grounding in the details of the National Electrical Code and a trained alertness for spotting explosion hazards in unsuspected places, they make a consulting or factory-engineer's job less onerous.

Their service is prompt and without obligation. Naturally they usually work on jobs of sufficient size to merit top-level attention, but even a small job with a large problem gets the same careful appraisal. If you'd like to talk or correspond with such a specialist, just write, wire or phone.

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DEVELOPMENTS...

SEPTEMBER 1957

Chementator

C. H. CHILTON

√ **New process for hydrogen refining of coke-oven benzene is said to get higher yields at lower pressures and shorter contact times. Developed by Britain's Coal Tar Research Assn., it's now in a 500-gal./day pilot plant.**

√ **Watch for entry of aluminum-coated steel strip, made via vacuum metalizing, as a low-cost competitor of electrolytic tinplate in the food container field. National Research Corp. is working on continuous process.**

√ **Simplified scheme to produce pure columbium and tantalum looks closer. Bureau of Mines, Albany, Ore., is operating continuous small-scale sulfuric acid-hydrofluoric acid-methyl isobutyl ketone system that coextracts pure metals and separates them via back extraction.**

How new plant will make zirconium

Broad outlines of Columbia-National's zirconium process are beginning to emerge from the shadows of secrecy, and it's apparent that the Pensacola (Fla.) plant, now in partial operation, involves much that's new.

Starting with zircon sand (zirconium orthosilicate), C-N first separates Zr from Si by fusing the sand with caustic soda and filtering the alkali-insoluble sodium zirconate from the soluble sodium silicate. The zirconate is then dissolved in nitric acid to form zirconyl nitrate.

Solvent extraction, using tributyl phosphate, separates zirconium from the 2% hafnium which always accompanies naturally occurring zirconium. C-N points out that TBP extraction at the same time gets rid of other undesirable metals (Ti, Al, Fe, etc.), leaving a high-purity zirconyl nitrate.

The nitrate is then thermally decomposed to get ZrO_2, which is fluid-bed chlorinated to $ZrCl_4$. Final steps are magnesium reduction and vacuum distillation to get pure zirconium sponge.

Horizontal scrubber slashes power cost

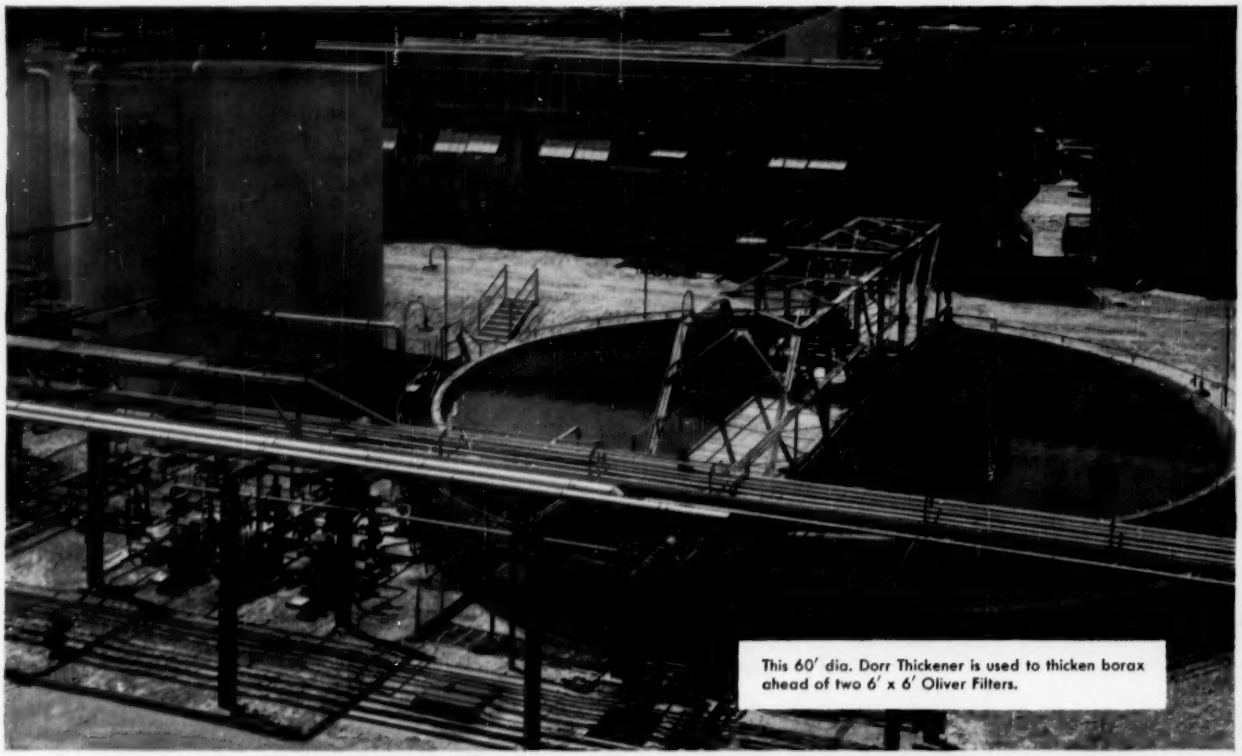
Something new in the field of gas absorption is now in successful operation at Courtaulds' viscose rayon plant in Coventry, England. It's a horizontal spray chamber for absorbing hydrogen sulfide in an alkaline liquor containing suspended ferric hydroxide.

Scrubber is 55 ft. long and semicircular in cross-section—30 ft. wide and 15 ft. high. Absorbent liquor (133 gpm.) is sprayed upwards at a 45-deg. angle from 140 orifice jets at ground level along each side. Foul air, containing H_2S, flows horizontally through the chamber at a rate of 125,000 cfm. or 6 ft./sec.

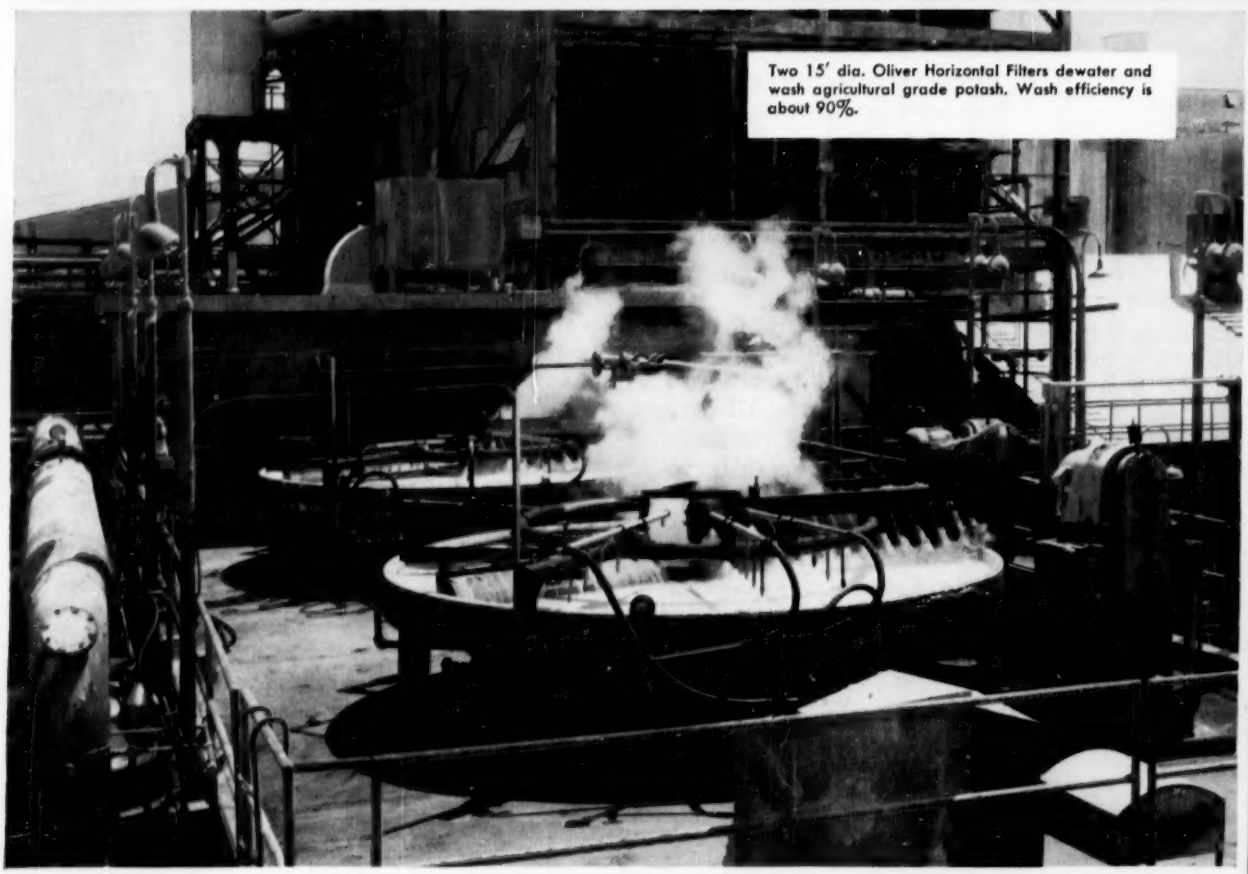
Why such an unorthodox design?

Courtaulds' engineers first approach to the air-pollution problem was a more conven-

(Continued on page 142)

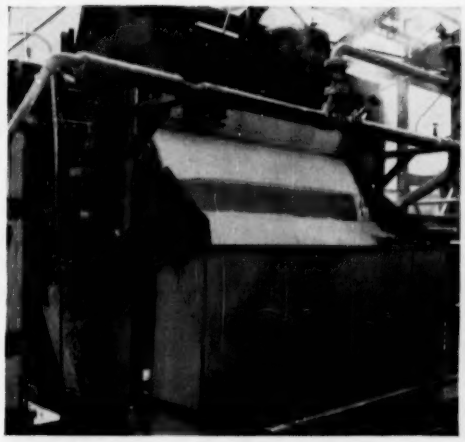


This 60′ dia. Dorr Thickener is used to thicken borax ahead of two 6′ x 6′ Oliver Filters.

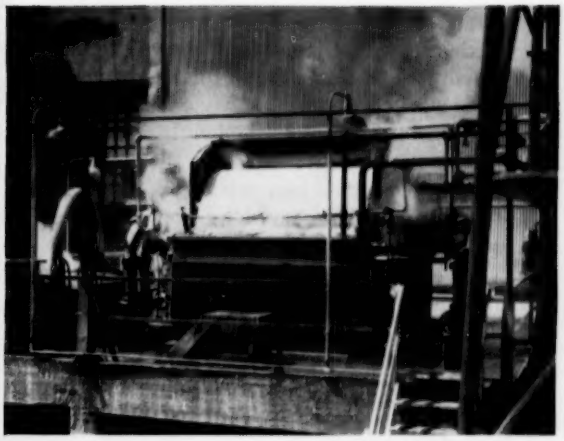


Two 15′ dia. Oliver Horizontal Filters dewater and wash agricultural grade potash. Wash efficiency is about 90%.





This 6′ dia. by 8′ fabricated stainless steel Oliver Salt Type Filter handles about 200 TPD of sodium bicarbonate. Note how clean the snap blow leaves the screen. A 2″ thick cake is discharged at 28% moisture with the aid of press rolls.



Another 6′ dia. by 8′ fabricated stainless steel Oliver Salt Type Filter handles approximately 100 TPD of sodium chloride. There are nine of these units in this section of the Trona plant operating on brine at 190°-200°F. Steam blow is used to keep the cover clean and snap blow discharge is very effective.

DORR-OLIVER TECHNIQUES

at American Potash & Chemical



TRONA

Tonnage producers of potash, sodium carbonate, borax, and sodium sulfate, American Potash & Chemical Corporation makes skillful use of Dorr-Oliver equipment and methods at their giant Trona, California plant. D-O Thickeners, Filters, and Classifiers are used in virtually every wet processing step in the flowsheet. On the Filters alone, over forty different units are installed . . . Oliver Drums, Oliver Salt Type, Horizontals and Sweetlands.

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tional vertical scrubber containing glass plate packing. They then found that the packing contributed nothing to performance, that the tower worked well as a spray chamber.

Someone then got the bright idea of turning the tower on its side as a way to save on pumping cost, the biggest single item in cost of operation. Hampered by lack of time for further pilot-plant work, Courtaulds gambled and went ahead with a full-scale horizontal unit. Result: better H_2S absorption at lower cost.

In addition to 40% reduction in power cost, the new scrubber was much cheaper in construction cost than its capacity equivalent in vertical towers.

Under normal operating conditions, H_2S content of the air is reduced from 300 ppm. to 13 ppm. Pressure drop over the length of the chamber is only 0.3 in. water.

Steel industry spurs magnesia demand

What's behind the present bustle of activity in the magnesia-from-sea-water industry?

- Kaiser Aluminum & Chemical recently doubled its facilities for handling sea water and added more than 50% to its periclase production at Moss Landing, Calif.
- Michigan Chemical is completing final engineering design for a 100 to 200-ton/day Gulf Coast plant.
- Westvaco is close to a final decision on whether to proceed with a plant on the Gulf Coast.

Kaiser reports that 85% of its plant output is now refractory-grade material, 15% chemical grade. Most of the refractory grade will be made into basic refractory brick and mortar at the firm's new Columbiana, Ohio, plant. A major share of the chemical grade will go to Pacific Northwest pulp mills using the magnesium bisulfite process.

Big demand for increased refractory output stems from needs of the steel industry, backed up to a lesser extent by the glass, copper and cement industries. Steel's needs have increased with a growing awareness that magnesia refractories do a better job than chrome in many cases. Since supply of foreign chrome is short and unreliable, there's added pressure for more magnesia.

Steel men now prefer magnesia for the bottoms of open-hearth furnaces to achieve maximum productivity. That's because magnesia is relatively insoluble in slag, withstands more abuse. Even for top and side linings, furnace engineers are specifying optimum magnesia levels that add to over-all demand.

Gas-cooled reactor looks even better

Included in a legislative plan now under consideration by the Joint Congressional Committee on Atomic Energy is proposed government backing for construction of a 40,000-kw. gas-cooled reactor similar to Britain's Calder Hall plant.

From a technological viewpoint, such a move now offers even greater promise in the light of a recent report from Great Britain. According to the U. K. Atomic Energy Authority, potential of the Calder Hall-type gas-cooled reactor looms much larger than foreseen originally.

Upshot of Calder Hall's success is that Britain's program of reactor development has been revamped to exploit the Calder Hall concept and to deemphasize liquid-cooled reactors. Development work on the gas-cooled reactor aims at boosting fuel temperature to 600 C. from present 400. This would increase electrical output of a typical two-reactor station from 300 mw. to 800 mw. Highest priority will be given to work on high-temperature uranium oxide fuel elements and fabrication of beryllium canning material.

Even so, interaction between graphite and CO_2-gas coolant will impose another temperature limitation. AEA is pushing ahead with investigations of the hydrogen-graphite reaction with a view to replacing CO_2 with hydrogen.

On another tack, AEA has included a scaled-down gas-cooled unit among several types under development for marine and surface transport. And a Calder Hall-type reactor is being designed to meet the large demand for a 30-mw. unit.

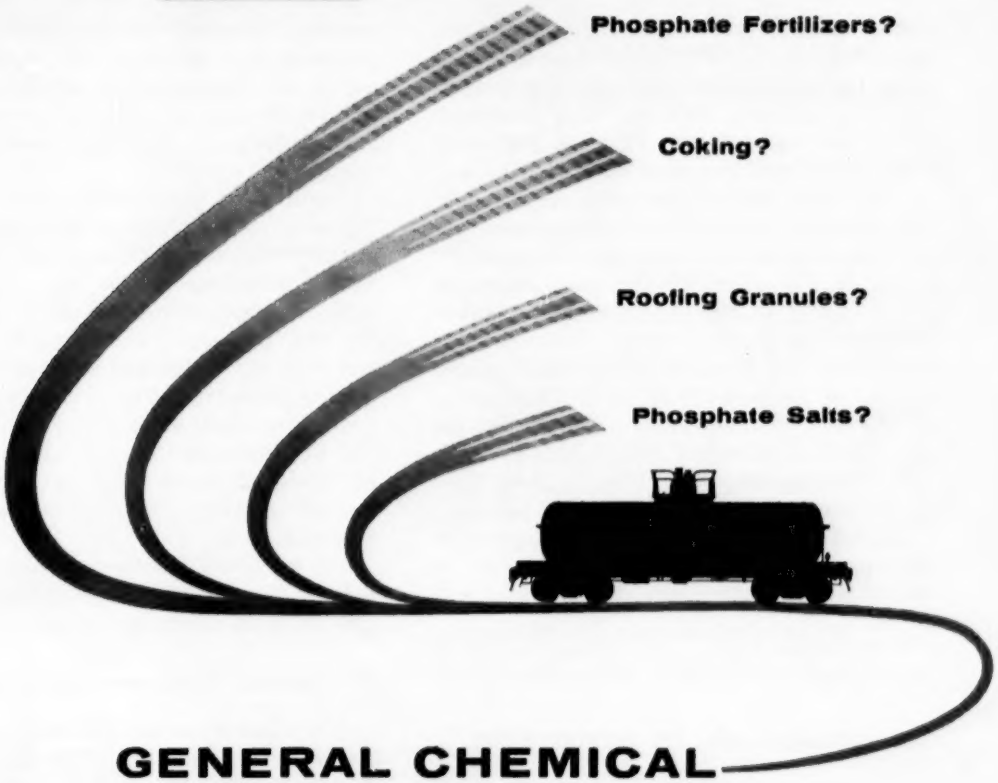
Slurry pipelining pays its own way

Successful cross-country pipelining of gilsonite from company mines at Bonanza, Utah, to processing plant at Fruita, Colo.—a distance of 72 miles—is more than an engineering triumph for American Gilsonite Co.

It's the key to Gilsonite's enviable economic position as a producer of high-octane gasoline and electrode-grade coke from this

(Continued on page 144)

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offers a superior quality of wet process

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Commercial and Fertilizer

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unique solid hydrocarbon (see *Chem. Eng.*, Sept. 1956, pp. 134-6). For the pipeline will enable the company to operate its new delayed coker and catalytic reformer on a feedstock costing well under $2/bbl. Prices of petroleum crudes in the area run more than $3/bbl.

The 6-in. pipeline, put into operation in May, traverses some rugged and desolate country, including a mountain pass at 8,430 ft. elevation. Flow through the line consists of a 38% slurry of crushed gilsonite in water. Reciprocating plunger pumps discharging at about 2,000 psi. force the slurry uphill to the summit of the pass; from there it's downhill all the way to the refinery. The descending slurry imposes a head of some 1,100 psi. at the end of the line which must be dissipated in a pressure-letdown system of smaller pipes.

Cost of transporting 700 tons/day of gilsonite from mine to refinery figures out at something like $1/ton, equivalent to less than 20¢/bbl.

Watch for feature article next month on the engineering design of this novel pipeline.

Ion exchange subs for refrigeration

Latest industrial use for ion exchange is stabilization of wine by partial removal of potassium and calcium ions which would otherwise cause tartrate precipitation after bottling. Wente Bros., Livermore, Calif., has just adopted this method following approval in April by the Treasury Dept.'s Alcohol and Tobacco Tax Div.

Conventional way to stabilize wine is to chill it to —4 C. Ion exchange eliminates the capital and operating costs for refrigeration.

Wente Bros. uses 0.5-2 cu. ft./1,000 gal. of Tartrex 160, a phenolic-base, sulfonic acid cation exchange resin made by Chemical Process Co., Redwood City, Calif. Resin is added to a batch of wine, agitated for a few minutes and separated by decantation or filtration. Continuous contacting in a column is too severe, adversely affecting other qualities of the wine.

Costing initially about $20/ton, the resin is regenerated by the manufacturer on a fee basis. Including regeneration, cost of treating the wine is less than 1¢/gal.

How to get double duty from pebble mill

At Rare Metals Corp.'s uranium concentration plant near Tuba City, Ariz., a ceramic-lined pebble mill grinds and acid-leaches ore in one step. So effective is the operation that the mill leaches as much as 90% of the uranium out of 250 tons/day of ore during a 6-min. retention. Remaining values are solubilized during a subsequent shortened leach in conventional wooden tanks.

Mill is standard 7x7-ft. steel unit, lined first with rubber and then with ceramic brick; alternate courses of brick sit on edge to form lifters. Grinding media are 2-in. alumina pebbles. Speed of rotation is 18 rpm.

Ore is slurried in the pebble-mill scoop box with hot water and sulfuric acid. Slurry density is controlled to 50% solids; acid concentration is held at 3.5-5% of the liquid phase.

Feed is under 1 in.; discharge is essentially all minus 35 mesh. Size distribution in the ground ore varies, with 35-50% running less than 325 mesh.

Some 90-95% of the ore fed to the process goes to the pebble mill; harder ores must be ground in an alternate rod mill circuit.

No power bill for new nitric acid unit

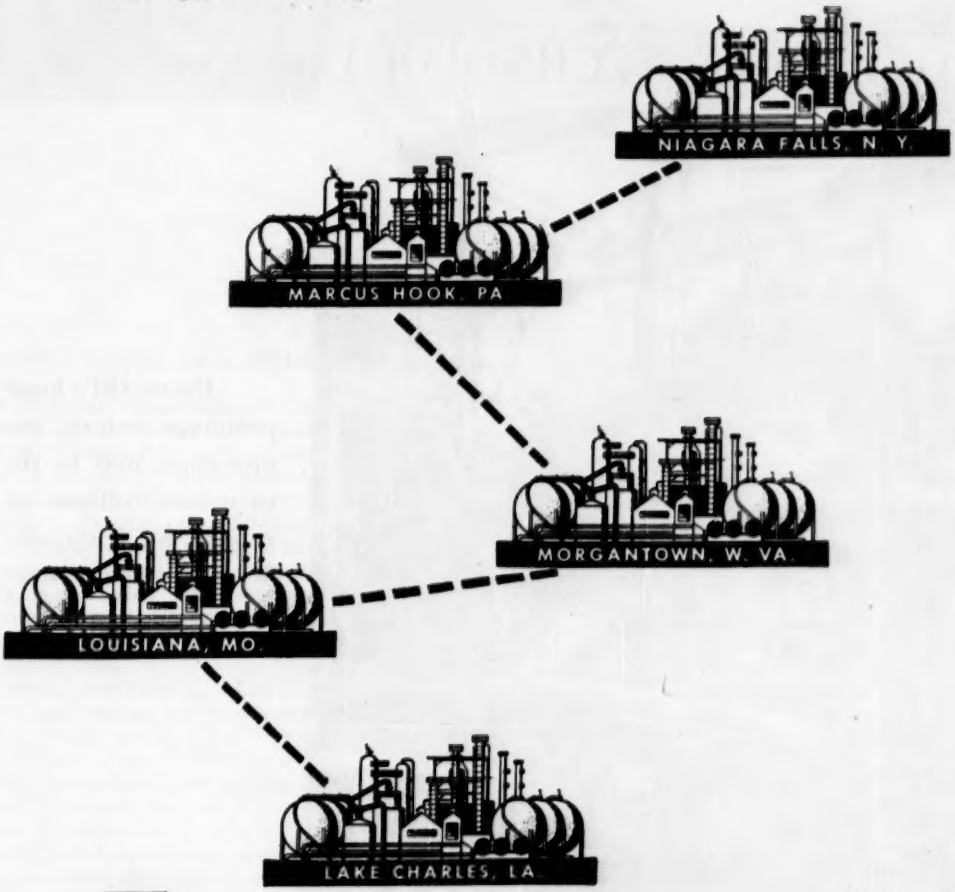
Squeezing the last Btu. till it hurts, Chemical & Industrial Corp. (Cincinnati) is engineering an ammonia-oxidation nitric acid plant for Atlas Powder at Atlas, Mo., which is expected to be self-sufficient in its energy requirements.

Big power consumer in such plants is the compressor which delivers air at 100 psi. to the catalytic converter. Although other modern plants supply as much as two-thirds of this energy by running the plant's reheated tail-gas through a turboexpander, the new $4-million, 250-ton/day unit will be the first in this country to run its compressor completely on recovered energy.

This will be done by generating 18,000 lb./hr. of 200-psi. steam in a waste-heat boiler which captures additional Btu.'s from the converter product gases. This steam goes directly to a steam turbine supplying one-third of the 600-hp. centrifugal compressor's energy requirements.

The 15% additional investment in power-recovery equipment, Atlas says, can be paid out in "a relatively short period." Large size of the plant, with its inherently better operating efficiency (especially as regards the compressor), contributes to this favorable economic situation.

For more on DEVELOPMENTS.....146



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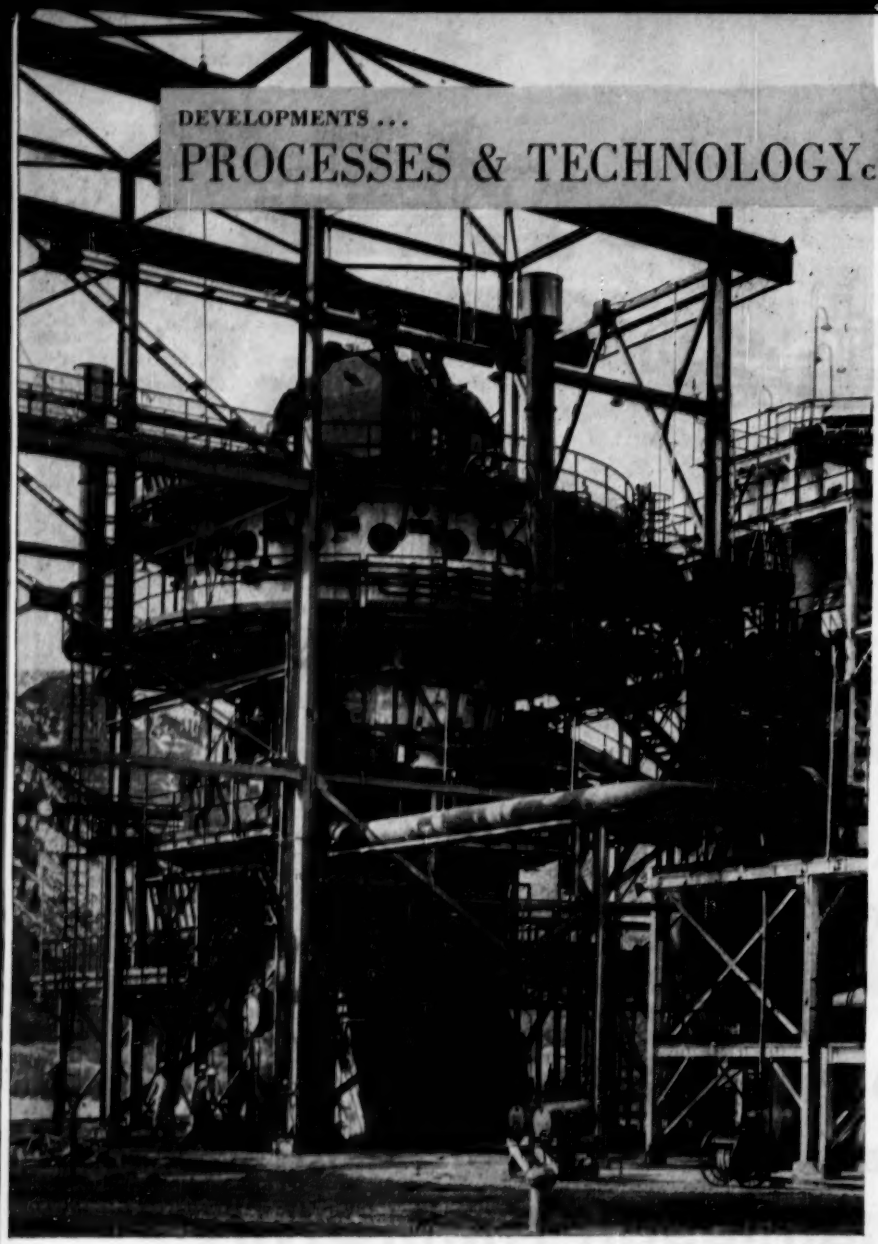
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Union Oil's huge new prototype retort, now in operation, may be the key to unlock billions of barrels of oil from our vast Western shale resources.

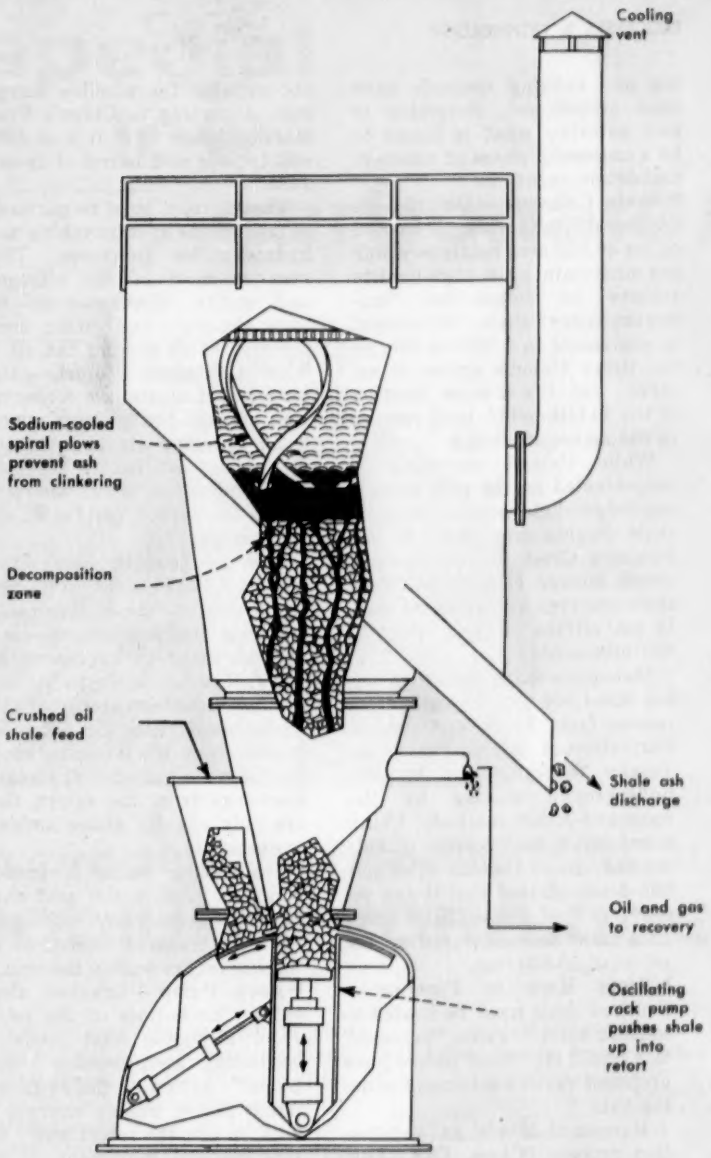
Shale Oil: Headed for the Big Time?

May 18, 1957, may go down in the annals of fuels technology as D-day in the campaign for an economic shale oil industry. For on that date Union Oil Co. of California dedicated its $1.5-million prototype oil shale retort near Grand Valley, Colo. Capacity: More than 300 tons/day of shale.

► **Giant Research Tool**—Role of the new unit in bringing about an active shale oil industry was indicated when Union's President A. C. Rubel stated, "The retort, as it now functions, is a large-scale research tool."

With experimental operations scheduled for this unit during the balance of 1957, Union Oil aims to wrap up its $8-million shale oil development by year's end. Union's aim is to establish whether its prototype retort will recover oil from rock shale in large volumes, at a cost which will make the entire process of mining, retorting and refining competitive with production of natural crude oil.

Rubel pinpointed Union's goal with the comment, "From its (retort's) performance under all sorts of varied conditions to which it will be subjected during the next few months, we expect to obtain operating, engineering and cost data which will enable us to design a full-scale plant



suitable for commercial production."

▶**Changing Conditions** — Union's entire setup at Grand Valley is geared to securing complete data over a wide range of operating conditions. They've got the equipment to vary conditions, measure the variables and analyze the results. And all hands at Union confidently expect their research group to find the right combination from the mass of data.

While over 4,000 bbl. of oil was produced during the two-month shakedown period prior to the dedication, Plant Superintendent John Pownall directed his efforts mainly toward training his operating crews. As he puts it, "It took that long for the men to realize that the unit is essentially self-controlling; the less they monkey with it the better it runs."

By now they are well launched on their evaluation runs. Before they are finished, Pownall's men will have checked out throughputs, yields and all possible sources of operating troubles.

▶**Gap Narrows**—From an economic standpoint, Union's development is approaching fruition at an opportune time. Cost of producing crude petroleum from new sources has risen to a level where oil from shale could become competitive.

During the past ten years, cost to find and develop new sources of crude oil has risen from 84¢/bbl. to $1.84/bbl. That this trend will continue is indicated by a comparison of capital requirements for producing, refining and marketing shale oil and petroleum.

In the United States, average capital cost per daily barrel for new and replacement petroleum capacity will increase from about $5,900 for the period 1950-1955 to more than $9,000 for the period 1960-1965.*

Capital requirements for a shale oil industry, based on cost levels existing January 1, 1957, amount to about $7,800 per daily bbl.† Thus, success at Grand Valley could very well launch a new industry with far-reaching results.

▶**Old Industry, New Technology** — Oil has been produced from shale for many years—in Scotland since 1850 and in Sweden since early in World War II. And in the U. S. (*Chem. & Met. Eng.*, 1924, pp. 611, 651, 688, 770, 884), it was produced on a limited scale until discovery of huge petroleum reserves in the 1920's made it uneconomic.

These previous techniques are not economical for our present needs. We require new large-scale mining, retorting and refining methods to make shale oil competitive with North America's petroleum.

At the present stage, both min-

* W. C. Schroeder, "Economic Possibilities for Liquid Fuels From Oil Shale and Coal in the United States," Energy Resources Conference, Denver, Colo., October 29-31, 1956.

† "Economic Significance of a Shale Oil Industry in Northwestern Colorado," Denver Research Institute, Denver, Colo., 1957.

ing and refining methods have been proved out. Retorting is now entering what is hoped to be a successful phase of commercial development.

▶**Shale Colossus**—Union's operation at Grand Valley is located on its 40,000-acre holdings which are underlain by a high-quality reserve of 30-gal./ton "mahogany-ledge" shale. Oil content is equivalent to 5 billion bbl., or ten times Union's crude oil reserve. Yet, it's a mere fraction of the 90 billion bbl. total reserve in the mahogany ledge.

While Union's operation is concentrated on the rich mahogany-ledge shale, total reserve of shale dwarfs even that. In the Piceance Creek Basin deposits, which include Union's holdings, shale reserves averaging at least 15 gal. oil/ton are equivalent to 960 billion bbl.

Mahogany-ledge shale lies under 800-1,000 ft. of overburden, ranges from 70 to 90 ft. thick. Formation of this deposit is unusually favorable for low-cost underground mining by the room-and-pillar method. Using a two-bench modification of this method, U. S. Bureau of Mines has demonstrated that it can recover 75% of the available shale at a total cost delivered to the retort of 50-60¢/ton.

▶**From Rock to Pipeline**—Crushed shale must be heated to convert solid organic "kerogen" to a liquid oil. Many people have proposed various schemes for doing this.

Bureau of Mines' gas-combustion process (*Chem. Eng.*, Aug. 1951, p. 202, and Nov. 1952, pp. 251-2) and Union's upflow retort (*Chem. Eng.*, Oct. 1952, pp. 313-7) have been the most serious contenders for ultimate success to date. Both have been through pilot operating phases.

A third process, a modification of the Swedish Aspeco concept, has recently started pilot operation at Denver Research Institute under sponsorship of Oil Shale Corp.

If shale oil is produced successfully in quantity in Colorado, it will likely be pumped via pipeline to refining centers for manufacture into gasoline, jet fuel and other high-quality commercial products. But crude shale oil directly from the retort is not suitable for pipeline pumping. According to Union's Fred Hartley, below 90 F. it is as difficult to pour as a barrel of frozen Jello.

Therefore, it must be partially refined on the spot by coking and hydrogenation processes. This removes most of the nitrogen and sulfur, eliminates or rearranges the wax-forming components which solidify the oil.

▶**Self-Contained Retort**—Union's retort maximizes conservation of heat for low-cost operation. Entering air is preheated by the hot ash before reaching the combustion zone, where it burns the carbon residue in the spent shale.

Flue gas from the combustion zone at 2,200 F. gives up its heat to preheated shale fragments, cracking the kerogen to gases and oil vapor at approximately 800 F. The hot vapor-gas stream, moving countercurrent to the shale, cools until the oil vapor condenses on the incoming shale. By the time gas and oil streams discharge from the retort, they are only slightly above ambient temperature.

No cooling water is needed, which is vital in the arid shale region of northwestern Colorado. All heat transfer related to retorting occurs within the unit.

▶**Rock Pump**—Crushed shale enters the bottom of the retort from a hopper that feeds an oscillating-reciprocating "rock pump." Action of the 5½-ft.-dia. pump piston pushes charges of rock up into the retort body. Entire upward movement of the shale results from this pump action.

Air is pulled down through the retort by a centrifugal blower, located downstream from a scrubber which removes entrained oil from the gas.

Shale oil is pumped to calibrated tanks. Gas from the retort is incinerated, although on a commercial operation its 80-100-Btu./cu. ft. content could be used for generating steam and power.

On top of the retort is a turntable which supports the plows used to break up the shale ash before it is discharged. Ash drops down a chute into a truck waiting to haul it to a dumping ground.

Both plow turntable and rock pump move very slowly. Undoubtedly this slow motion will permit long life for the moving parts. According to Pownall, the rock pump has worked like a dream ever since startup—a good omen for the over-all retort operation.

GE Reveals Long-Term Fusion Research Program

Another industrial firm has lifted the veil from long-range research activities in controlled fusion reactions.

General Electric vice president and director of research, Guy Suits, recently announced that GE has been carrying on "a substantial program" in this field for more than a year. This followed closely an announcement by General Dynamics that it was cooperating with a group of Texas utility companies in a similar program (*Chem. Eng.*, Aug. 1957, p. 162).

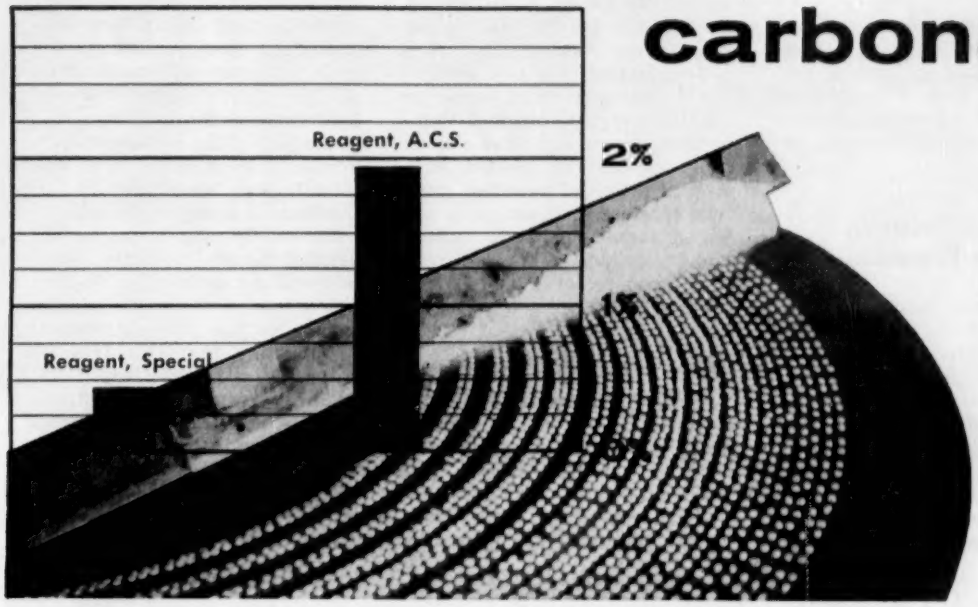
Here, in Suits' own view, is a tentative schedule for controlled-fusion power; Realistic appraisal of fusion process—5 years; technically feasible process—maybe 10 years; pilot-plant production in 20 years; and, beyond that, competitive nuclear power.

Shell Chemical to Test New Waste-Disposal Well

Shell Chemical Corp. has finished drilling at its Houston, Tex., plant a $166,000 waste-disposal well that may prove to be an economical way of disposing of process waste streams. Although Shell now uses several successful waste-disposal methods at the site, the new well is expected to be more economical for increased volume of waste.

Well reaches a depth of 7,650 ft. (3,000 ft. below nearest potable water), will be lined from top to bottom with steel casing and enclosed in concrete from ground level to 3,000 ft. As a further safeguard against contaminating water, there is a layer of impervious rock between level of injection and water plateaus. Injection sands, according to Shell geologists, ex-

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Assay (NaOH)	Min. 97.0 %
MAXIMUM LIMIT OF IMPURITIES	
Sodium Carbonate (Na_2CO_3)	2.0 %
Chloride (Cl)	0.005%
Nitrogen Compounds (as N)	0.001%
Phosphate (PO_4)	0.001%
Sulfate (SO_4)	0.003%
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tend into west Texas in one direction and hundreds of miles into the Gulf of Mexico in the other.

The well will be turned over to Shell technical men for thorough economic evaluation, consisting of test injections of fresh water and process streams to check rate of flow into the sands.

Dryers Put Twists in New Resin Processes

In doubling capacity of its polyvinyl chloride plant at Houston, Tex., Diamond Alkali is incorporating new process versatility that allows shifts in production emphasis to meet sales requirements.

Plant will be able to produce suspension resins, paste resins and vinyl acetate copolymer in varying quantities. Built-in versatility results from adding three different facilities for drying: rotary dryer, spray dryer and air-lift dryer. Additives can be blended before, during or after polymerization.

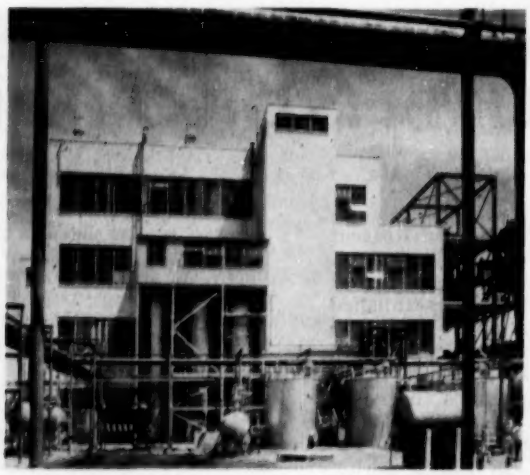
Too, Diamond is now designing a monomer plant based on an HCl-acetylene process. Compressed, scrubbed and dried acetylene will be reacted with HCl in multiple, fixed-bed catalytic reactors. Effluent gases will be condensed, partially refined and piped into the crude storage tank farm to serve as feed for polymer processes.

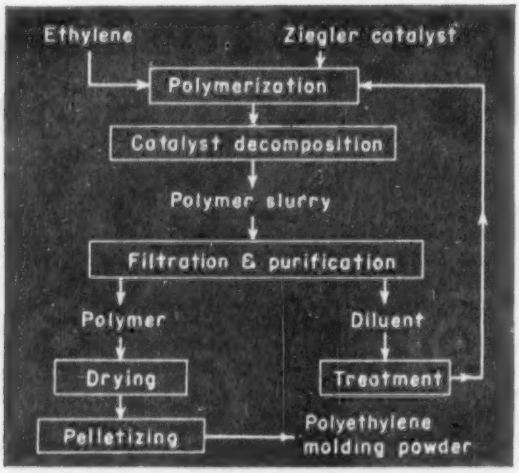
Metal Wall Thickness Can Limit Heat Transfer

Heat transfer in centrifugal, thin-film processing units is so fast that, with some corrosion-resistant metals (e.g., stainless steels), the wall thickness can become the limiting and most important heat-transfer factor.

A. R. Gudheim, Kontro Co., and J. Donovan, Artisan Metal Products, cited such a case when discussing these recently developed machines at the ASME-AIChE Joint Heat-Transfer Conference at State College, Pa., in August. This particular unit involved a 36-in. cylinder. It was actually more beneficial, said the speakers, to make the cylinder to withstand 50-psig. steam in the heating jacket, with its lower temperature difference, than it was to beef up the wall thickness enough to use 150-psig. steam.

Admitting that this type of unit (*Chem. Eng.*, July 1955, p. 278) is comparatively expensive per unit heat-transfer area, Gudheim and Donovan suggest that chemical engineers use such machines only if the job at hand can't be done well enough in conventional equipment.





New Hercules Plant Is First in U. S. to Use Ziegler Process

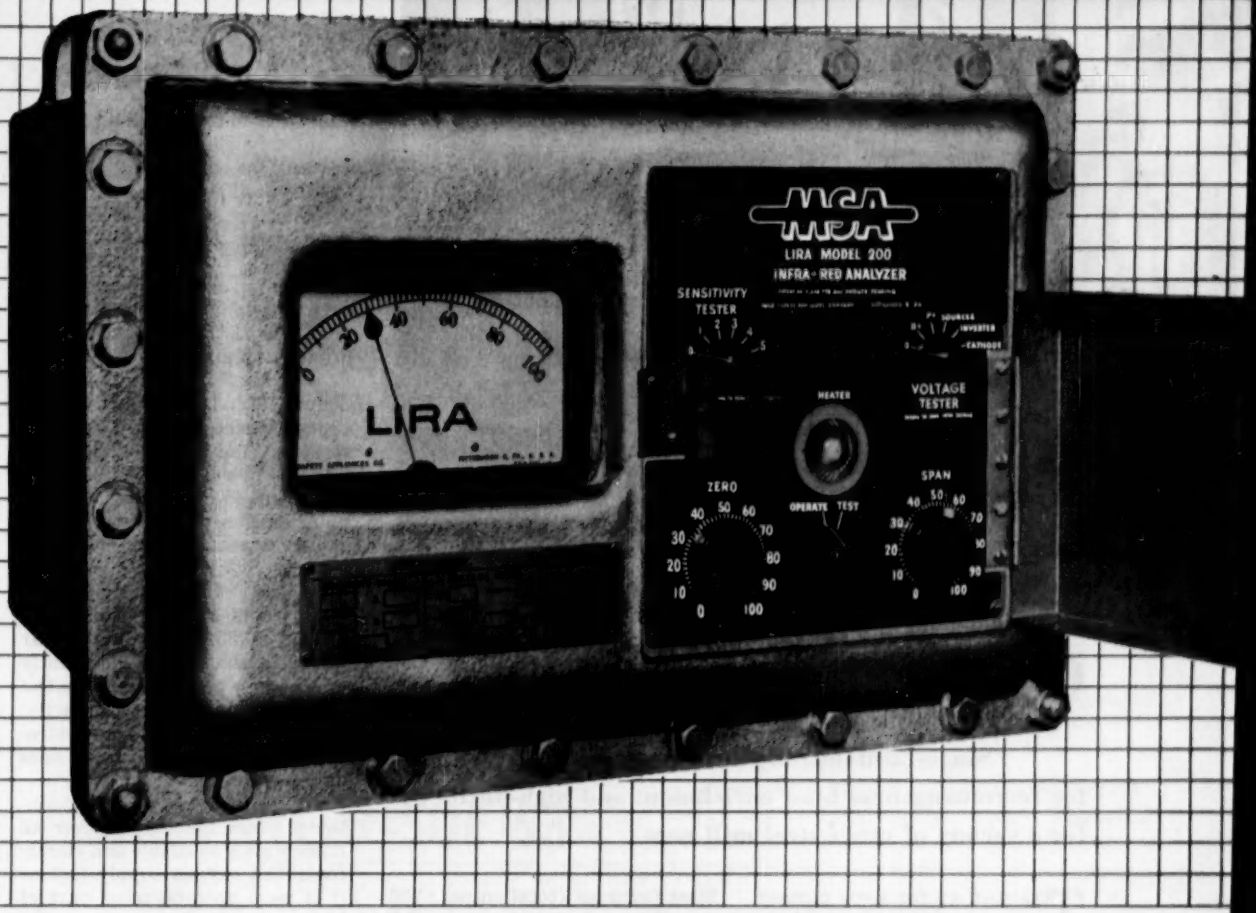
Hercules Powder Co.'s new plant at Parlin, N. J., is first in the U. S. to produce commercial amounts of high-density polyethylene by the low-pressure Ziegler process. Plant makes 30 million lb./yr. of new Hi-Fax.

In contrast with earlier high-pressure processes, which operate at temperatures up to 500 F. and pressures of 30,000-60,000 psi., Ziegler operating conditions are 70-200 F. and near-atmospheric pressures.

Ziegler catalyst system uses organo-aluminum compounds activated with certain heavy-metal derivatives. Typical of these are aluminum triethyl and titanium tetrachloride. Experiments leading to new catalyst provided key to host of metal alkyl mixed catalysts.

In Hercules process, polymerized ethylene is formed as a slurry with catalyst and diluent. Polymer is separatd from suspension as small-particle-size solid, purified and dried. Then polyethylene is colloided and formed into pellets, suitable for molding, plain or in color. Ethylene is piped from Esso facility at Bayway.

Hercules developed process in an exchange of technical know-how with German firm, Farbwerke Hoechst, world's first producer of high-density polyethylene.



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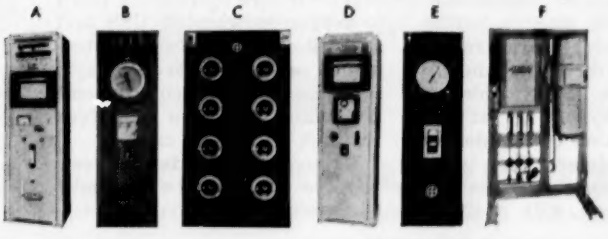
Here's an inexpensive deflection type infrared analyzer for automatic, continuous, high-speed, accurate analysis.

The LIRA Analyzer Model 200 detects one component in a simple or complex mixture of gases or liquids. It's ideal for controlling continuous or batch processes, for determining and controlling product quality, and for measuring toxic and combustible gases or vapors from a few parts per million to 100% of gas.

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Design simplicity and small, compact size make service and maintenance quick and easy on the new M-S-A LIRA Analyzer Model 200. Unitized construction makes all controls easily accessible. And for extreme sensitivity, stability and selectivity, the Model 100, incorporating the Null Balance principle, is also available.

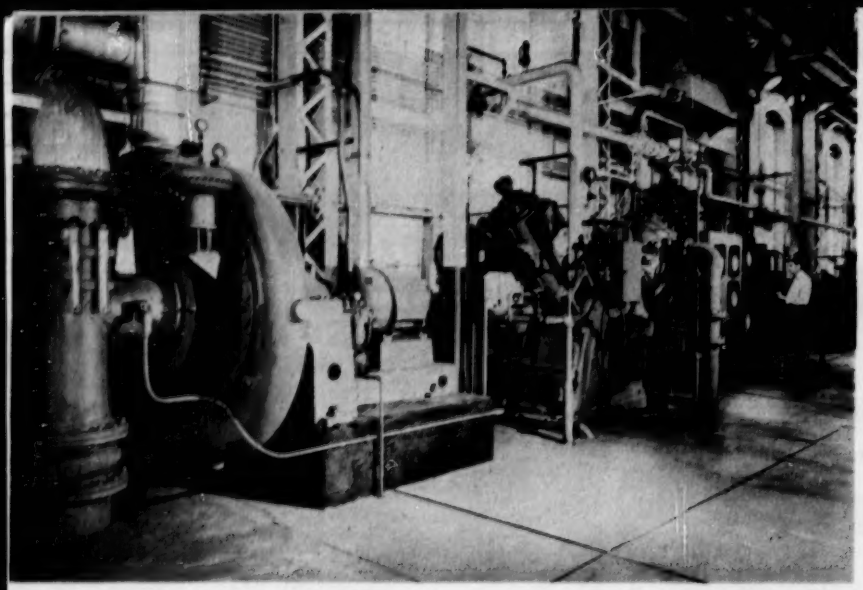
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Oxygen Plant Fills Dual Role

Single 500-ton/day unit turns out low-purity gas for ferromanganese blast enrichment and high-purity gas for a variety of other steel mill uses.

TEAMING up for some pioneer process engineering, Linde Co. and U. S. Steel Corp. have registered impressive advances both in ferroalloy and oxygen technology at the steel company's Duquesne (Pa.) works.

In ferroalloys: USS has converted its ferromanganese blast furnaces to oxygen-enriched air blast—a long-eyed but seldom-tried scheme—and so reaped handsome operating economies.

In oxygen: Linde has engineered a flexible plant to turn out both high-purity and tonnage-purity oxygen from a single column, so meets all the steel mill's oxygen needs with one compact, on-site facility.

Central figure in this dual development is a $3-million, 500-ton/day oxygen plant swung on stream in May at Duquesne. Built, owned and operated by Linde on ground leased from USS, the new installation rates as the largest oxygen unit serving a steel mill.

▶ **Versatile Function** — Some 430,000 cu.ft./hr. of 95% gaseous oxygen from the plant goes as 6%-oxygen-enriched air blast to USS's two ferromanganese blast furnaces (total output: 700 tons/day metal). "As a result," reports Duquesne General Superintendent Graham, "we expect to boost furnace output over 25% and slice coke consumption per ton of metal by 5-10%."

In addition, plant turns out about 42,000 cu.ft./hr. of 99.5% gaseous oxygen for traditional steel mill oxygen-consuming jobs like electric-furnace operations, scarfing and deseaming. Remainder of plant's output, as high-purity liquid oxygen, goes to keep a 10-million-cu.ft. standby storage tank filled as insurance for the mill against oxygen-plant shutdown.

▶ **Veteran Cycle Revamped** — Oxygen production is based on the widely used German Linde-Fraenkl low-pressure cycle that was originally intended to produce 95% oxygen exclusively. To convert it to multiple-purity operation, Linde (U. S.) re-engineered the over-all flowsheet.

For example, Linde added a high-purity oxygen tap at the condenser section of the double rectification column. Then it replaced the usual ammonia refrigeration cycle with a throttling valve and expansion turbine to provide the bulk of its refrigeration needs via the Joule-Thomson effect. Needing still more cooling because of the low pressure of the air stream at the outset, Linde harnessed all cold product oxygen to do cooling duty in added exchangers. And the regenerators were redesigned for maximum efficiency.

"Further," points out R. Cooper, Linde's oxygen plant superintendent, "we had to instrument for exceptionally close temperature control, engineer all auxiliary equipment for maximum efficiency and manage our reflux streams for the best effect."

▶ **On-Site Philosophy** — This plant represents the 17th in a string of 33 somewhat similar packages that Linde's currently building to add 3 billion cu.ft./mo. of oxygen to its capacity. And it stands as a good illustration of Linde's evolving sales philosophy.

An on-site plant, Linde maintains, offers the oxygen user an immediately available and closely controlled oxygen supply just as if it were an integrated part of his own over-all operation. Yet the customer doesn't tie up capital funds for his own plant, shucks headaches and costs of operation, maintenance and obsolescence. Moreover, Linde stresses, the plant is backed by a nationwide production and distribution setup to doubly insure adequate supply.

In the case of steel mills like Duquesne this last point is particularly significant. There, peak oxygen-use periods are often followed by deep valleys in the demand curve. A backup like Linde's means that it's not necessary to build an oversize facility to take care of the hefty but intermittent peak periods and run way under capacity the rest of the time.

▶ **Oxygen-Enrichment Controversy**—Before committing itself to oxygen enrichment, USS first ran full-scale tests over a three-month period. To do the job, it called on Linde to bring in some 200 million cu.ft./mo. of oxygen via tank trucks and cars.

Reason for the extensive tests was the fact that the economics and mechanics of oxygen enrich-

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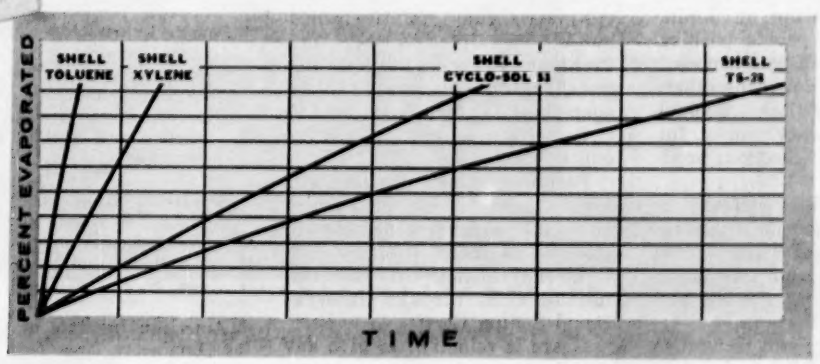
SHELL CYCLO-SOL 53 ... an excellent solvent with higher flash point and slower evaporation than xylene. Recommended for bake finishes and flow coating.

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ment in blast furnaces are still matters of controversy. To date only two other outfits besides USS have tried it, and with mixed results.

Bethlehem Steel at Johnstown, Pa., turned a 2%-enriched air blast into its ferro furnaces in 1942 but has since abandoned the practice as uneconomical. Weirton Steel at Weirton, W. Va., has used a 3% enrichment in its pig iron blast furnaces since 1951 and is highly satisfied with the results.

While happy with the results in the ferro furnaces, says Graham, USS doesn't plan to use oxygen enrichment in its pig iron furnaces. Why not? With ferro furnace coke consumption some 2½ times that of pig iron operation (3,400 lb./ton metal vs. 1,300 lb./ton) and ferromanganese prices running about three times that of pig iron, it pays to soup up ferro blast furnace operation. Gains made there easily pay off the added cost of oxygen while it's doubtful, as far as USS is concerned, if that would be the case in pig iron blast furnaces.

▶ **Oxygen Process Lowdown** — Here, in brief, is how Linde's revamped low-pressure oxygen cycle operates:

Air, entering through a screen filter, is compressed to 75 psig. in a turbine-driven, 42,000-cfm., two-stage centrifugal compressor. It's water cooled and then fed to a bank of four parallel-hooked, 25-ft.-high by 10-ft.-dia. regenerators for initial cooling and refrigeration.

The four regenerators operate in pairs, alternating on 5-min. cycles. Ceramic pebble packing in one unit of each pair is cooled while air passes down the other. Then streams switch. Coolant for one set is waste nitrogen, for the other the 95% oxygen product.

Air temperature drops to about −250 F. in the regenerators, and CO_2 and water freeze out. When stream switches, coolant purges out the ice and dry ice.

After passing through a silica gel adsorption column for further purification, air stream flows through a throttling valve and expansion turbine to atmospheric pressure. This gets a saturated liquid air stream at about −295 F. that feeds to the base of a 60-ft.-high, 10-ft.-dia. bubble-cap, double rectification column. Recycle streams pass through added exchangers against high-purity product streams to get additional cooling.

▶ **Product Destinations** — Overhead of gaseous nitrogen from column serves as coolant in one set of regenerators, then goes to waste. The 95% oxygen from the lowest plate in the upper section of the column passes through the other regenerator set. Then, as a gas, it's boosted to 2 psig. in a single-stage centrifugal blower and fed through a 24-in. pipeline to the ferromanganese blast furnaces.

High-purity oxygen gas from the auxiliary heat exchangers is stepped up to 200 psig. in a double-acting base-load compressor, followed by a single-acting booster compressor, to feed other mill needs via a 12-in. pipeline.

A 99.5% liquid stream from the column keeps at least 6.5 million cu.ft. of oxygen in storage tank to provide a 15-hr. backup for the blast furnaces. Reason: A sudden loss of oxygen, USS reports, could "freeze up" the furnace charge.

Another Company Will Make High-Purity Silicon

Add another firm to those already hustling transistor-grade-silicon processes into commercial operation (*Chem. Eng.*, July 1957, p. 144).

New company, jointly owned by W. R. Grace & Co. and Pechiney, French chemical and metallurgical company, will be operating a new plant in the U. S. within a year. Capacity will be 20,000 lb./yr.

Pechiney is now turning out highly pure silicon in France, and under arrangement between the two partners, the new firm is already selling this material in the U. S. through International Selling Corp.

Grace is reluctant to give any details concerning process operation (*Chem. Eng.*, Aug. 1957, pp. 164-166), but explains that process to be used was developed by Pechiney.

Convention Calendar

First International Conference on Operations Research, Oxford University, Oxford, England, Sept. 2-6.

American Chemical Society, 132nd national meeting, New York, N. Y., Sept. 9-13.

Instrument Society of America, 12th annual meeting, instrument-automation conference and exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

American Institute of Chemical Engineers, Lord Baltimore Hotel, Baltimore, Md., Sept. 15-18.

American Society of Mechanical Engineers, fall meeting, Mayo Hotel, Tulsa, Okla., Sept. 23-25.

Standards Engineers Society, 6th annual meeting, economy through applied standardization, Hotel Commodore, New York, N. Y., Sept. 23-25.

American Oil Chemists' Society, symposia on soaps, detergents, color specification and measurement, Netherland Hilton Hotel, Cincinnati, Ohio, Sept. 30-Oct. 2.

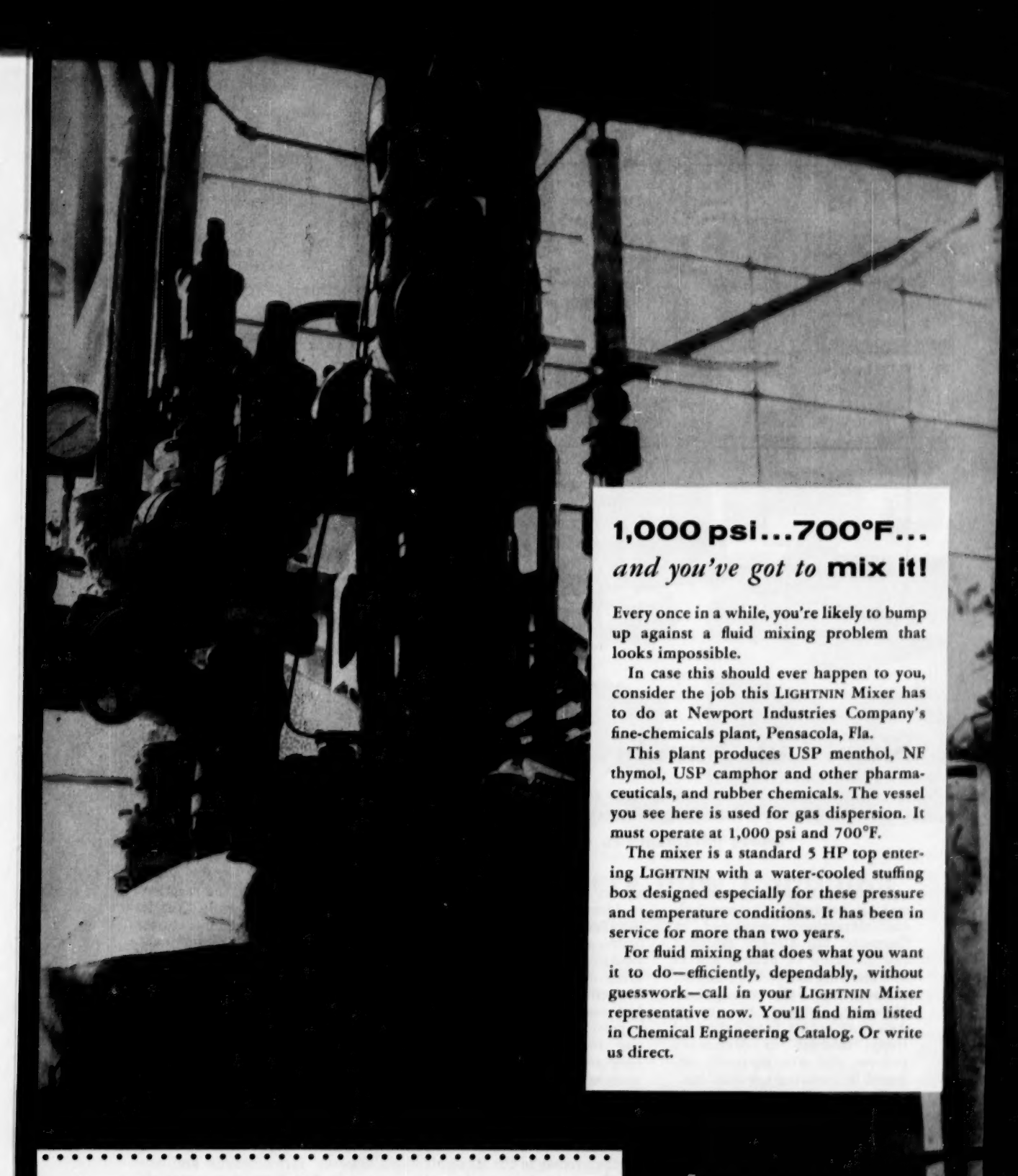
European Federation of Chemical Engineering, congress, Zurich, Switzerland, Oct. 3.

Technical Assn. of the Pulp and Paper Industry, 12th annual plastics-paper conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, Oct. 7-9.

Fourth Lubrication Conference, sponsored jointly by American Society of Lubrication Engineers and American Society of Mechanical Engineers, Royal York Hotel, Toronto, Ont., Oct. 7-9.

Scientific Apparatus Makers Assn., midyear meeting of the recorder-controller section, Seaview Country Club, Absecon, N. J., Oct. 15-18.

American Institute of Chemical Engineers, New York Section, all-day symposium, Hotel Statler, New York, N. Y., Oct. 22.



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This plant produces USP menthol, NF thymol, USP camphor and other pharmaceuticals, and rubber chemicals. The vessel you see here is used for gas dispersion. It must operate at 1,000 psi and 700°F.

The mixer is a standard 5 HP top entering LIGHTNIN with a water-cooled stuffing box designed especially for these pressure and temperature conditions. It has been in service for more than two years.

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- ☐ Top entering; propeller types: ¼ to 3 HP (B-103)
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- ☐ Side entering: 1 to 25 HP (B-104)
- ☐ Laboratory and small-batch production types (B-112)
- ☐ Condensed catalog showing all types (B-109)
- ☐ Quick-change rotary mechanical seals for pressure and vacuum mixing (B-111)
- ☐ Data sheet for figuring mixer requirements (B-107)

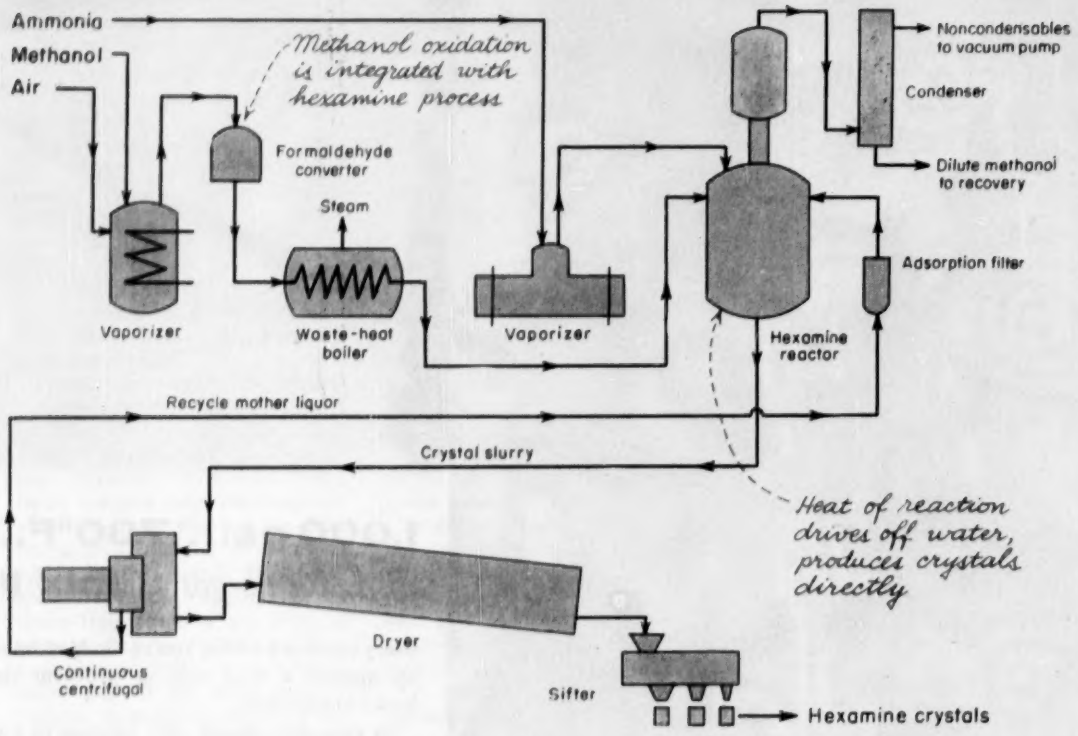
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Lightnin Mixers

MIXCO fluid mixing specialists



Short Cuts Simplify Hexamine Process

By combining some steps and eliminating other, new continuous process scores advantages in compactness, low operating costs, higher purities.

A new continuous process for making hexamine (hexamethylene tetramine), developed in Germany, has already spawned two offspring in France and is now reaching across the Atlantic.

According to the firm of Josef Meissner, Cologne, two major American outfits have expressed lively interest in Meissner's process and are currently engaged in licensing negotiations.

Groomed for two years in Meissner's 1,100-lb./day pilot plant, the new hexamine process offers a slate of attractive economies that are pretty hard to ignore. High on the list stand slashed utilities consumption, improved product purity and yields, coupled with marked savings in investment and labor.

First to cash in on these features is a French government agency that Meissner is not free to identify. The French plant, installed for $100,000—a modest figure, since it includes costs of licensing and engineering—turns out more than 4 tons/day hexamine. Brought on stream last year, it served, initially, to supplement an existing 4-ton/day batch facility. But now, solidly sold on the continuous process' advantages, the French agency has contracted for a second 8-ton/day plant and plans to scrap the batch installation.

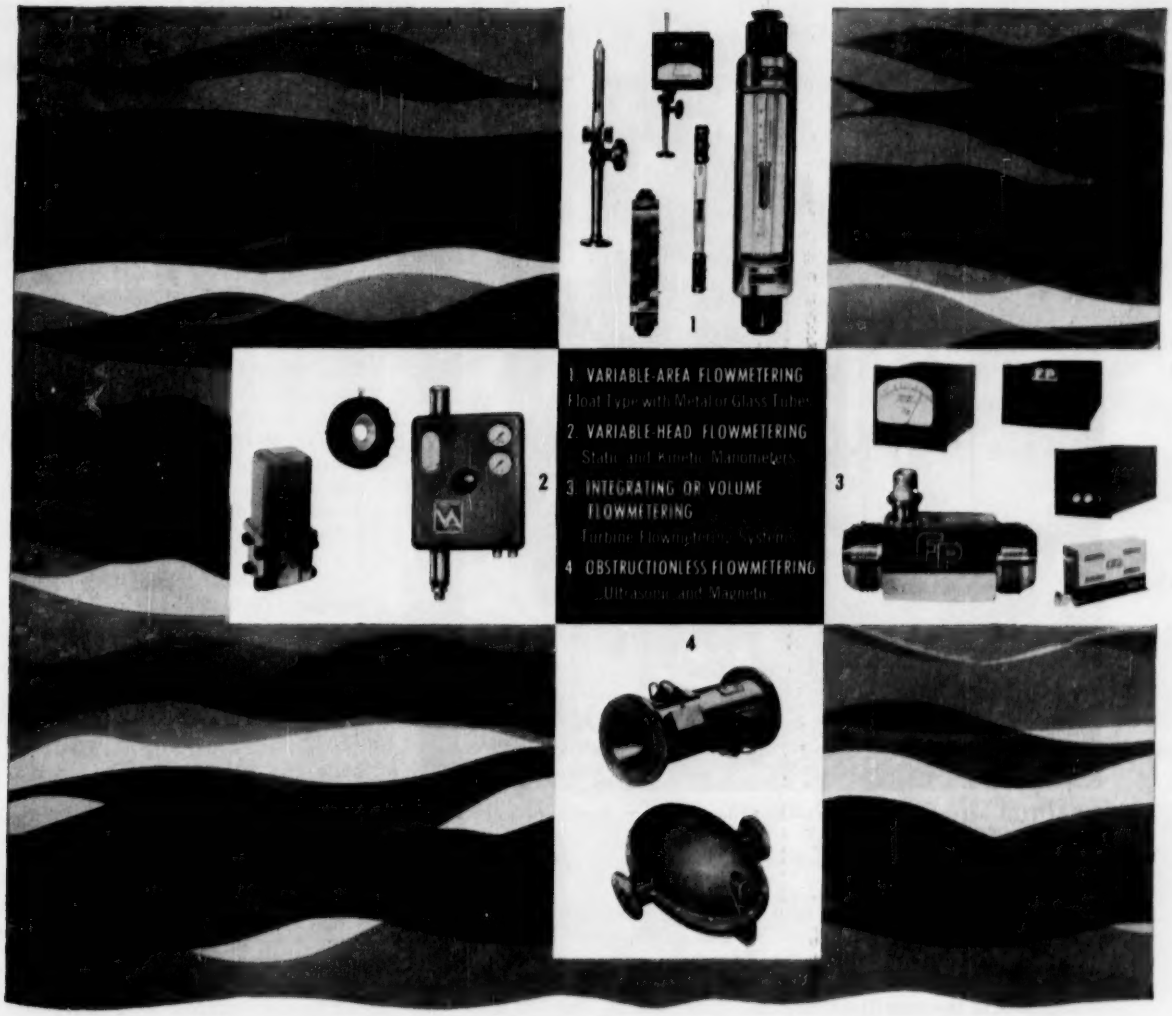
▶ **Commercial Problems**—Basis of the process is the straightforward reaction between formaldehyde and ammonia to produce hexamine and water. But to economically commercialize this reaction, especially on a continuous basis, poses some knotty problems.

In the first place, the reaction is extremely exothermic. Yet it must be run at low temperatures to avoid introducing contaminating side reactions. Thus, reaction heat must be removed rapidly from the reaction zone.

Then there's the problem of recovering the hexamine from a dilute aqueous solution. Conventional processes turn up the hexamine in 10-20% solutions because, in addition to the six moles water produced per mole hexamine by the reaction, they introduce more water by using aqueous formaldehyde and ammonia for their raw materials.

▶ **Combined Solution**—Meissner hurdles such problems with these process innovations:

First, it cuts down the amount of water present by using gaseous formaldehyde. Integrating



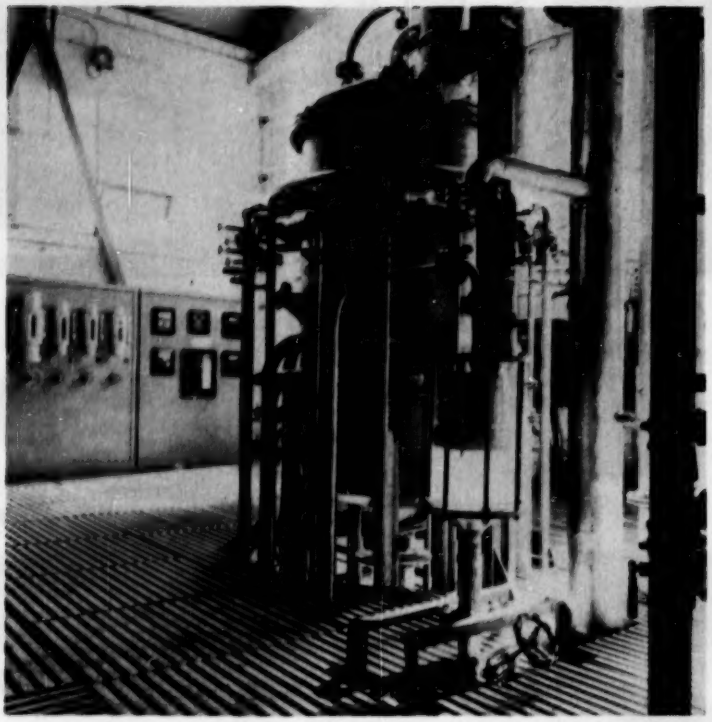
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Complete Process Instrumentation



REACTOR serves also as formaldehyde absorber, hexamine crystallizer.

formaldehyde manufacture into the continuous hexamine flowsheet, Meissner pipes exit gases from a formaldehyde converter straight into the reaction vessel. There, hexamine solution absorbs the formaldehyde from other gases. Too, ammonia enters the reactor as a dry gas.

Then, the new process removes the high hexamine reaction heat by harnessing it to concentrate the hexamine solution, boiling at reduced pressure. As a result, a 50% solution is produced from which the hexamine crystallizes out right in the reactor.

▶**Garners Economies** — Meissner cites these features of the continuous process:

• High reaction speed of continuous process, faster by one-third than batch, means a high throughput rate and a compact installation. Further, with concentration of hexamine solution and hexamine crystallization taking place in a single stage, vacuum evaporators, crystallizers and crystal size-separators are absent from Meissner's flowsheet. And since formaldehyde is absorbed from converter gas in the hexamine reactor, absorbers and distillation columns are not needed in the formaldehyde-making end of the operation.

• In harnessing reaction and hydration heats to do its evaporating job, the process reduces steam requirement by 8 lb./lb. hexamine. In many cases, Meissner points out, this much steam saved can add up each year to as much as half the cost of the installation. Moreover, not faced with the need to cool the reactor to keep reaction temperature down, Meissner's route slashes cooling water consumption in half.

• Continuous process permits a completely automatic plant. This means good control of operating variables for uniform product and maximum operating efficiency. The process improves hexamine yields some 5%, reports Meissner, pushes reaction to about 99% completion with a minimum of side reactions. And automation coupled with a simplified flowsheet cuts labor needs; not more than two men per shift are required.

▶**How Process Works**—Formaldehyde is made by continuous catalytic oxidation of methanol with air over a silver catalyst. Exit gases from the converter, containing methanol, CO, CO_2, hydrogen, steam and nitrogen as well as formaldehyde, are cooled from 1,110 F. to about 260 F. in a waste-heat boiler. They feed, along with ammonia vapor, to the reactor.

The stainless steel reactor consists of two vessels stacked vertically. Each is filled with aqueous hexamine solution and each doubles as a formaldehyde absorber.

Converter gases and ammonia enter the lower "bunk" of the reactor; formaldehyde and NH_3 are absorbed. Hydration and reaction heat drive water vapor into the upper vessel, carrying along inert gases and any unreacted formaldehyde and ammonia. All remaining formaldehyde and NH_3 react there upon absorption in solution.

Reactor runs at 125-160 F., with temperature controlled via total pressure in reactor through a vacuum pump. Rate of reaction is controlled by metering ammonia stream slightly in excess of stoichiometric.

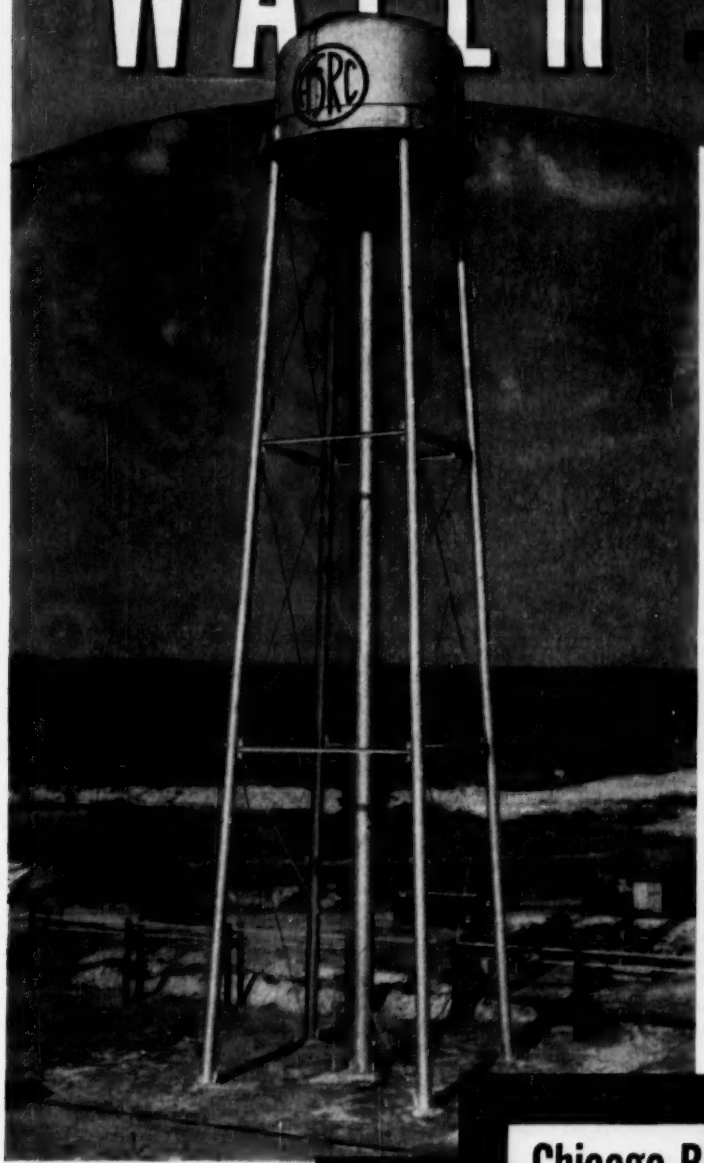
Offgases pass out the top of the upper reactor to a water-cooled condenser. There, any methanol present is condensed and recycled to the formaldehyde converter. Offgases, containing up to 20% hydrogen, are wasted or used for combustion.

▶**Crystallizing** — Hexamine-crystal slurry is pumped continuously from the bottom of the reactor to a centrifuge. Crystals are separated and washed with distilled water. Mother liquor recycles through an adsorption filter to remove any impurities produced by side reactions in the reactor.

With washing of crystals and filtration of recycled mother liquor, purity of product is maintained. And added wash water does not dilute the hexamine solution since reaction heat is enough to evaporate it. Hexamine crystals from the centrifuge are dried continuously, then are sized in a sifter and packaged for market.

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Above: 100,000-gallon Horton ellipsoidal-bottom elevated tank 125-ft. to bottom, built for sprinkler service at American Synthetic Rubber Corporation, Louisville, Kentucky.

Instruments Spark Control Lab Evolution



Today's trends in plant control labs:

- **From "wet" or test-tube methods to "dry" or instrument methods.**
- **From manual recording to automatic recording of test results.**
- **From macroanalytical techniques to micro and semimicro techniques.**
- **From commonplace equipment to low-cost models of research instruments.**

THERE'S been a lot of change in analytical laboratory equipment and techniques since school days, when we strained all afternoon over our samples, titrating and back-titrating to the faintest pink endpoint.

Technological advances have wrought fundamental and far-reaching improvements in routine analytical work for production control. These changes are so varied and on so many fronts that it's sometimes hard to get a clear view of just where chemical control lab practice is headed.

According to makers and users of control lab equipment, these changes are pretty well covered by the four trends listed above. These trends answer industry's needs for more speed, greater reliability, more efficient use of men and materials.

▶ **For Speed: Spectroscopy** — Most talked-about change is the burgeoning use of spectroscopic instruments in the control lab. New or modified equipment is introduced with bewildering frequency. You can get a quick idea of the more important developments in this field from the box at right.

These instruments, combined with the trend to automatic recording of results, afford time-saving analyses and simple operation. They make it easier to keep an eye on trends, permit replacing highly trained personnel with technicians.

Dramatic vindication of these trends can be seen from the example of one chemical company that installed a recording emission spectrometer. With conventional wet methods, five chemists needed about 4 hr. to run tests. Now a single chemist can run 60 tests in about 1 hr. and get better product control.

Another widely heralded control lab technique is vapor-phase chromatography (*Chem. Eng.*, June 1956, pp. 116-120). What makes this method especially attractive is its versatility, low cost and simple operation. Cost of chromatograph installation ranges from $1,000 to $7,000; infrared analyzers are around $15,000. Chromatographs don't need professionally trained men to operate them as do infrared analyzers.

▶ **For Problems: Practice** — Even with improved instruments, there are still problems that will have to be ironed out in practice for individual cases.

One control lab instrument

The Boom in Control Lab Spectroscopy

Infrared—widely used for gas analysis in control labs.

Mass Spectrometry—headed for control lab use; low-cost model out now.

X-Ray Spectroscopy—now used for variety of production control purposes.

Nuclear Magnetic Resonance—control lab unit now available.

Electron Paramagnetic Resonance—at least one control lab unit in use.

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man points out that impurities in samples often give headaches. Such stumbling blocks as dust, water vapor or trace impurities can play havoc with the workings of infrared analyzers and mass spectrometers. Lab personnel, this expert cautions, will have to bone up on their chemistry to cope with tricky or unexpected analysis problems. (He's a former assistant chief chemist, himself.)

Too, gas chromatographs and infrared analyzers have to be calibrated with standard gases which sometimes stratify, vary in composition. He adds that it's a good idea to check accuracy of instruments periodically by more conventional analytical methods.

▶**Charts the Easy Way**—Automatic recording for analytical instruments is becoming more important in control labs.

One instrument man puts it this way: "Laboratory apparatus isn't working up into process use; rather, it's recorder-controller instruments working down into the lab area."

Reliable records insure constant quality from batch to batch or during a continuous process, provide a good method of watching trends. And automatic recording saves a lot of time.

Fisher Scientific recently introduced an all-purpose automatic recorder, is now working to improve and extend its usefulness. Recorder can chart anything that can be shown to it as a change in current, voltage or resistance.

▶**Micro Analysis Cuts Cost** — Use of micro and semimicro analytical methods is gaining. Most micro analyses shave 10-75% off the time needed for conventional methods. Micro work takes up less lab space, means more safety when working with hazardous materials. And savings in reagent costs can be considerable.

Improvements in micro balances and micro burets are opening new doors for fast, efficient micro work. Carbon, hydrogen, nitrogen, halogens, sulfur, phosphorus, many metals, acid and saponification values, methoxyl and ethoxyl content and molecular weight can now be determined accurately on a few milligrams of sample.

▶**Toward Automation**—It's not hard to foresee the time when completely automatic control labs—sampling, analysis and recording—will be common.

A British instrument firm, Baird & Tatlock (London), already boasts of one such fully automated analytical lab. Electromagnetically controlled valves admit samples and reagents to testing vessels. Control units determine the sequence and duration of tests, while feedback signals serve as a check that operations go as scheduled.

Type of analyzing and recording units depends on the sample to be analyzed. For example, British atomic energy researchers at Harwell use the automated lab to test uranium liquors. The lab draws measured samples automatically from four different sources, adds two reagents to each sample, sends the mixtures to an absorptiometer, compares color intensity against a known standard and records the results.

Along with other phases of chemical processing, control lab operation seems to be trending toward more automation, speedier service, better use of technical manpower and materials.



Lab-on-Wheels Plugs into Process, Solves Problems

In use at Sun Oil Co.'s Marcus Hook, Pa., refinery, this mobile laboratory can wheel to any key process point, plug in to analyze streams, solve design and operating problems. Lab carries gas chromatograph, data logger, computer equipment.

New Process Slashes Sulfur Content in Iron

Research conducted for Diamond Alkali Co. by Battelle Institute has produced a new continuous process for removing sulfur from iron.

Process feeds molten iron and caustic soda continuously to a mixing chamber, drawing off desulfurized iron and slag. Substantial amounts of silicon are also removed by introducing a jet of oxygen into the mixing chamber.

Low final sulfur content indicates process may find use in production of ductile iron and in desulfurizing pig iron for steel.

new Misericordia Hospital will

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BY INSTALLING

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Lowering one of the 43,500 lb FW Packaged Steam Generators into the basement of the Misericordia Hospital.

SCHEDULED for completion early in 1958, the $8,000,000, 210-bed Misericordia Hospital, Bronx, N.Y., will be fully equipped with the finest and most modern facilities obtainable.

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* **SAVE TIME** — because they were completely shop fabricated and delivered by truck direct to the building site, all ready to set in place and connect to power, fuel and steam lines.

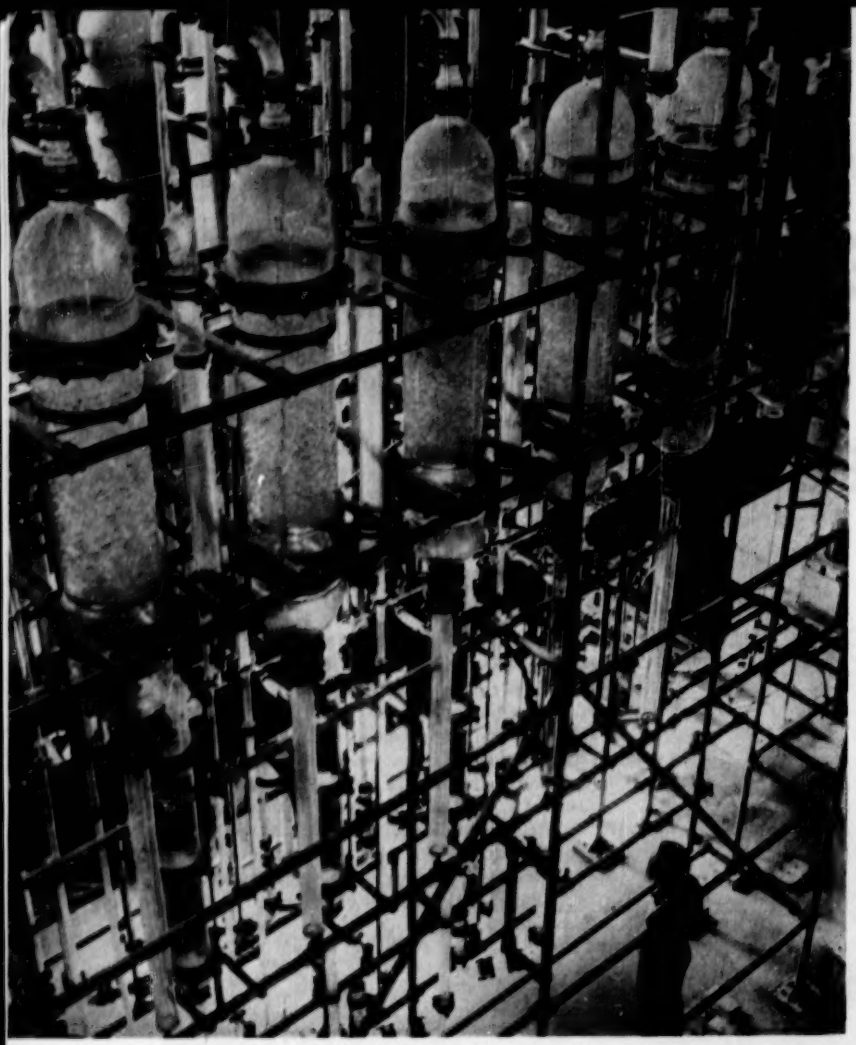
* **SAVE SPACE** — because of exceptionally low ratio of unit size to quantity of steam produced. Measuring only 12'1½" high, 10'11½" wide and 16½' long, these 17,500 lb/hr units are installed on small, low-cost foundations.

* **SAVE MAINTENANCE** — because they are specially designed for easy servicing and inspection. Consisting almost entirely of water heating and steam producing pressure parts, there is a minimum of refractory and tile maintenance.

FW Packaged Steam Generators are available in capacities from 10,000 to 60,000 lb/hr and pressures to 1300 psi. For complete information, send for Bulletin No. PG-55-3. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

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ABSORPTION of bromine takes place in these ten packed glass columns.

New Route to Bromine

Cold absorption of bromine in sodium bromide solution is key step in new process which slashes consumption of fuel and chemical reagents.

Israel, sorely tried by too much desert and too much politics, has turned to the chemicals-rich Dead Sea* for a large part of her economic strength and is cultivating a hardy chemical industry along its burning, barren shores.

Latest desert rose to blossom at Sodom is a new bromine plant traveling a recently patented (U. S. 2,784,063) process route. Its novelty: Absorption of bromine from a bromine-air mixture with chilled sodium bromide solution. Its attraction: A simplified flowsheet that offers marked savings in investment and operating costs.

Put into operation last December by Israeli-government-backed Dead Sea Bromine Co., the $1.3-million installation turns out 1,250 tons/yr. of bromine from the concentrated end-brine byproduct of neighboring Dead Sea Potash Works. Before the end of this year plant output will be stepped up to a rate of 2,000 tons/yr.

▶ **Plus Dibromide**—DSB is now adding an ethylene dibromide plant at the site, slated on stream early next year. It will take 1,600 tons/yr. of the bromine produced, convert it to 1,800 tons/yr. of ethylene dibromide.

Both plants have been designed with an eye on further expansions. For, as a company spokesman points out, the new process gives DSB a highly competitive bromine product with an extra plus in exceptionally high purity. Here's how:

▶ **Separates Polybromides**—The bromine in the brine feed, as magnesium bromide, is freed by chlorination, then blown out of solution with air. Then the new cold absorption step is used to separate the air-bromine mixture.

Sodium bromide solution at about 0 F. reacts with the bromine to form addition compounds of elementary bromine and ionic bromides (Br_{n+1}^-). These polybromides are stable liquids and have a low vapor pressure at the low temperature. And they dissolve readily in excess sodium bromide solution, thus are separated from the air.

Then to recover bromine, the polybromides are dissociated by heating in a still. Sodium bromide recycles for another absorption turn; bromine goes to market.

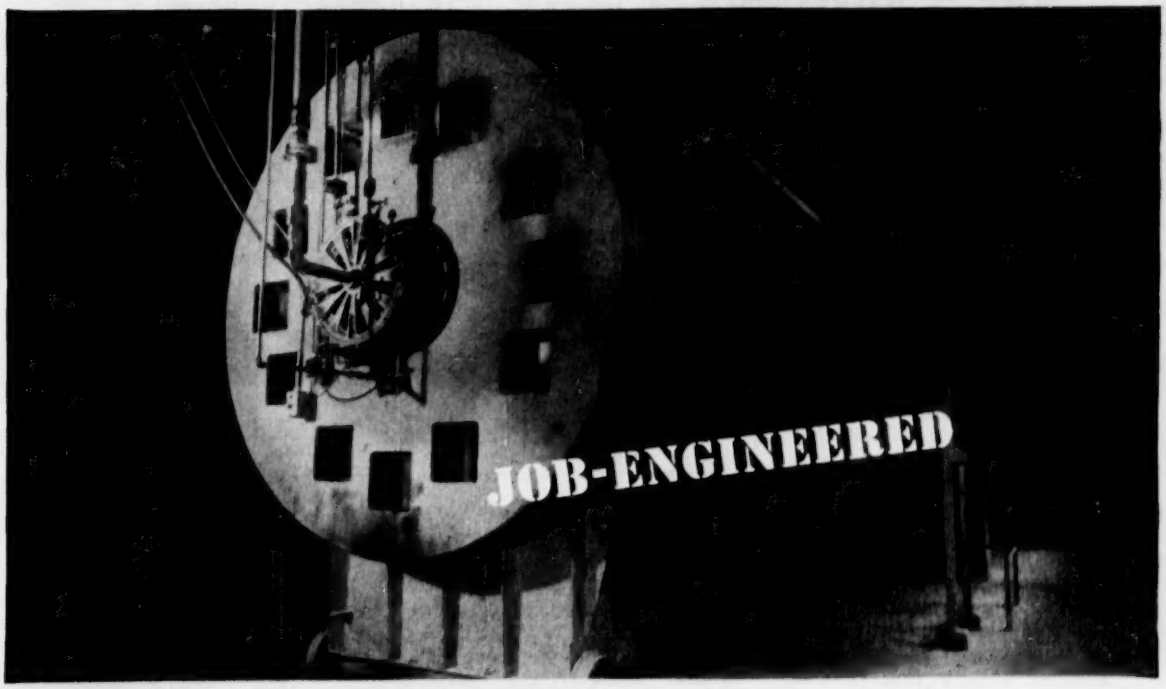
▶ **Less Reagents, Fewer Steps**—In comparing this cold absorption route with more conventional processes, DSB points out that the new process garners its advantages primarily by sidestepping need for large volumes of costly reagents and by slicing the number of operating steps required.

For example, bromine is frequently recovered by scrubbing the air-bromine mixture with alkaline (NaOH or Na_2CO_3) solutions to form NaBr and $NaBrO_3$. Then a subsequent sulfuric acid reaction frees the bromine. Or SO_2 is reacted with the air-bromine stream in the presence of water to form HBr. This, in turn, has to be scrubbed with an alkaline solution to get NaBr,

* Fed by the highly saline springs of the Jordan River and Lake Kinneret, the Dead Sea contains some 25% dissolved solids. And, with its only outlet the evaporation provided by the beating desert sun, this mineral concentration is ever steadily increasing.

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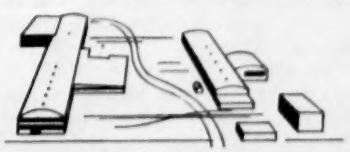
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Deep into the earth—1800 feet, deepest in the nation's potash industry—National Potash near Carlsbad, N. M., is mining for food to feed the earth, so that the earth will feed man better! Designed refinery capacity is 400,000 tons per year. And at the heart of this operation are 60-foot-long twin rotary dryers—*job engineered* Standard-Hersey dryers—designed and built by Standard Steel Corporation... a world leader in designing and manufacturing dryers, granulators, and coolers. Wide range and flexibility in Standard-Hersey dryers help you to produce almost any desired grade of fertilizer.

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To meet the ever increasing needs of its world-wide customers, Standard Steel Corporation recently purchased the Leader Iron Works at Decatur, Illinois. Founded in 1888, Leader is well known for its work in the food, chemical and petroleum industries. In addition to its customary fabrication Leader will now manufacture Standard's line of heavy processing and road construction equipment.

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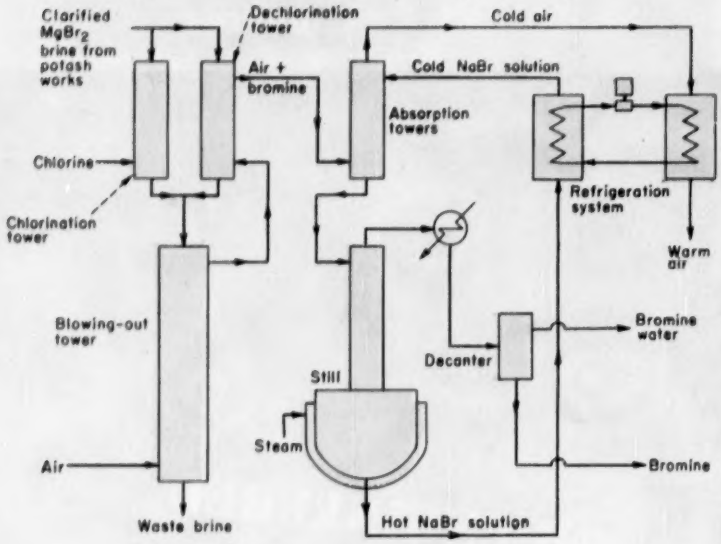
General Offices and Factory, 5005 Boyle Avenue, Los Angeles 58, California

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which then is chlorinated to recover the bromine.

The cold absorption route also scores against the "steaming" bromine process widely used in Europe. In that process, after the usual chlorination of the brine, the bromine is blown out of solution with steam instead of air. Bromine is separated by condensing the steam. But the process requires some 20 tons steam per ton of bromine—about 15 times more than the Israeli process. And that means a large fuel bill that fuel-poor Israel, especially, can't afford.

▶ **Plus High Purity**—Moreover, the process produces a very high purity bromine product, ranging from 0.01 to 0.02% Cl_2 as compared to the generally accepted commercial standard of 0.2%. According to Y. Picker, DSB's managing director, no other manufacturer can match Israeli bromine on this score.

This feature, coupled with savings in reagents, operational steps and fuel, DSB claims, offsets the added expense of the refrigeration needed to chill the sodium bromide.

All equipment in the plant is fabricated from glass and ceramic to resist the corrosive action of bromine.

▶ **How Process Works** — End brine from the potash plant, containing 10,000-12,000 ppm. of magnesium bromide, feeds to earthen basins where suspended solids settle out. Clarified solution is pumped to the top of glass-chip-packed chlorination towers. Chlorine gas passes countercurrently up the tower. Reacting with the bromide to form $MgCl_2$, it frees the bromine which, however, remains dissolved in the brine.

Brine then goes to the top of a glass-chip-packed stripping tower. Air is blown up through the tower to carry out the free bromine. Some 150,000-200,000 cu.ft. of air at 190 mm.Hg and 95 F. is required per ton of bromine.

Gas stream, containing about 15% bromine by weight, then passes up through a glass-packed dechlorination tower. There, a countercurrent brine stream, tapped from the feed stream, removes excess chlorine, rejoins feed stream at the top of the stripping tower.

▶ **Cold Absorption** — Dechlorinated air-bromine gas stream then feeds to the absorption towers. Two parallel rows of five series-hooked, glass-chip-packed columns make up this stage. Gas stream enters at the bottom of the columns, passing countercurrently to an aqueous solution of 350 g./liter sodium bromide at about 0 F. Bromine vapor is absorbed in and reacts with the sodium bromide to produce the polybromides. Saturated absorbent, containing about 35% bromine by weight, leaves the last tower at about 50 F.

A steam-jacketed still, operating under slight vacuum and at the boiling point of sodium bromide solution (230 F.), dissociates the polybromides. Steam and bromine vapor from the still are condensed, with water separated from the bromine in a decanter. Bromine then goes to storage. DSB claims that it gets 90% bromine recovery.

Hot sodium bromide, tapped from the bottom of the still, recycles to the evaporator of an ammonia refrigeration system. Once chilled, it goes back to the absorption tower. The cold air, stripped of bromine, leaves the top of the absorption tower and serves to cool compressed ammonia before it is vented.

German, U. K. Chemicals: Hot Competitors in 1957

Latest rash of chemical developments in Britain and Germany spell stiffer competition for U. S. chemical processors.

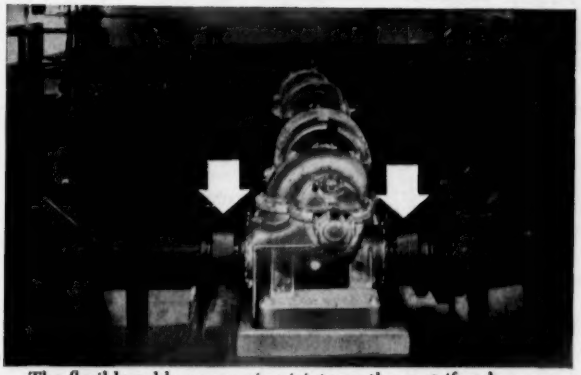
British chemical outlays this year will rise 23%, compared with 15% for iron and steel, 14% for other metals and 9% for mining, according to Business and Defense Services Administration.

Concurrent with this news is Imperial Chemical Industries' announcement that it will boost expansion spending this year by about $17 million (to $140 million), plans to have a new $280-million petrochemical plant operating by mid-1970's. The huge plant, to be located on a 1,000-acre site in Gloucestershire County, will produce organic and inorganic chemicals, but will rely largely on oil as raw material.

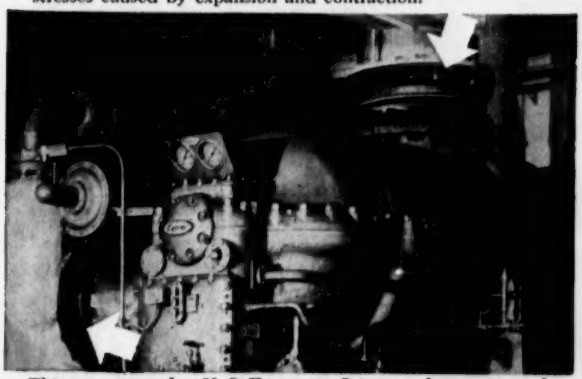
Though heavy chemicals have been active, petrochemicals continue to be most rapidly expanding sector of Britain's chemical industry. Expansion plans call for bigger outputs of phthalic anhydride, maleic anhydride, cyclohexylamine, lubricating oil additives. (*Continued*)

EXPANSION JOINTS

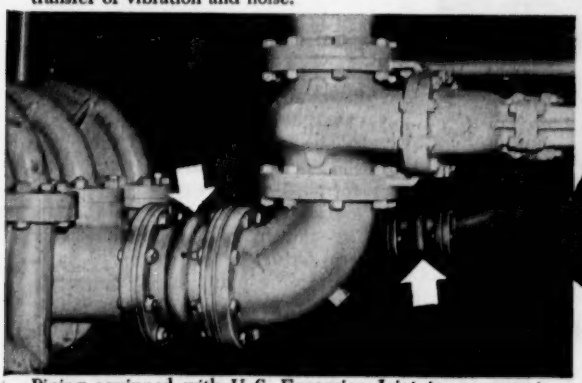
Expanding the Designer's Scope



The flexible rubber expansion joints on the centrifugal pump installations (above) are made by U. S. Rubber. They prevent stresses caused by expansion and contraction.



This compressor has U. S. Expansion Joints on the suction and discharge lines. Like all U. S. Joints, these insulate against the transfer of vibration and noise.



Piping equipped with U. S. Expansion Joint to compensate for any misalignment caused by load stresses, wearing of parts or settling of building.

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- They absorb both axial and lateral deflection far more than metal joints. Greater insulation against vibration and pump noises. No electrolysis, corrosion or erosion.
- Handle pressures from 40 lbs. to 125 lbs.
- The outside diameter of the arch is smaller than on metal joints. (Face-to-face dimensions, even with multiple arches, are smaller.)
- Weight is much less. This, plus the fact that no gasket is needed between flanges (metal joints require gaskets) results in an easier installation lowering the cost.

"U. S." was the *first* to develop expansion joints. They are at work in every kind of industry, prolonging the life of equipment in pressure or vacuum pipe systems. Some are still in service, after 30 years of operation. Obtainable at any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.



For the complete technical information catalogue on the entire line of U. S. Rubber Expansion Joints, contact your nearest "U.S." District Sales Office or write us at Rockefeller Center, New York 20, New York.

Mechanical Goods Division

United States Rubber

West Germany chemical exports and imports in the first quarter of 1957 were each about 25% higher than in the same period last year, boosting exports to about $260 million, imports to about $90 million.

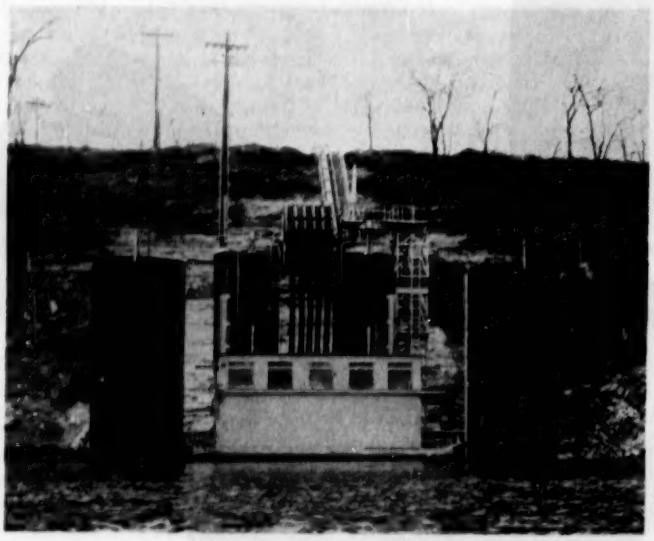
Inorganic and heavy industrial chemicals, totaling more than $63 million, continued to form the biggest dollar slice of total chemical exports. Next came plastics, $26.6 million; pharmaceuticals, $22.6 million; nitrogenous fertilizers, $16.2 million.

Against this background of healthy, expanding activity, recent developments may prove a spark to new fields of chemical endeavor.

▶ **To Build Russian Plant** — Krupp, Essen, has received an order from Soviet government to build a synthetic fiber plant in Russia at a total cost of about $4 million. This is the first big Russian order given to German industry since World War II. Among other products the plant will produce dimethyl terephthalate under German-licensed process.

Uranium ore finds have prompted the West German government to salt away $832,000 more in its 1957 larder of $20 million for uranium prospecting and processing. Ore deposits are located in states of Bavaria and Baden-Wuerttemberg. Only one of the deposits, Woelsendorf, shows uranium rocks similar to the famous East German Joachimstahl mines. Woelsendorf deposits have at least five rocks of pitchblende together with fluorite containing 2,000-6,000 grams of uranium per ton of ore. Other deposits run about 250-700 grams/ton.

It's clear that scrappy German industry may be readying bids for larger-scale atomic energy program, freer trade with Soviet bloc countries. In any case, there's going to be more competition for U.S. industry.



Floating Pump Station Rises and Falls with River

Four pumps, each of 4,000-gpm. capacity, are housed on this Dravo-built floating barge, deliver 14 million gal./day of process water to Ford Motor Co.'s new glass plant near Nashville, Tenn. As Cumberland River rises and falls, cable arrangement turns reel, adjusting hose length. Five 12-in.-dia. rubber hoses (one for standby pump) feed water through reel axle to pipeline ashore. River level can vary 35 ft.

Process Gives Antistatic Properties to Fabric

Following a rash of new rot-proofing processes, a process imparting permanent antistatic properties to Arnel triacetate fibers has been developed by Celanese Corp. of America.

R. G. Stoll, director of Celanese's textile labs at Charlotte, N. C., says the process creates a skin of cellulose around each Arnel filament. Skin constitutes about 2% of the weight of the total fiber, is not removed by washing or wearing.

Stoll emphasizes that the process produces a chemical change in the surface of the fiber, renders it hydrophilic and hence antistatic.

Process can be carried out with conventional drying and finishing equipment but will not work on other hydrophobic synthetics such as polyesters, acrylics or nylon.

New Process Unit to Win Gasoline in Natural Gas

Delta Tank Mfg. Co. is marketing a new type of processing unit that can reportedly recover thousands of barrels a day of raw gasoline previously lost in natural gas streams.

New hydrocarbon recovery unit, called Dryex, is fully automatic and designed primarily for use on relatively small and lean natural gas streams. A full-scale pilot-plant unit has been operating since February on a cooperative trial installation with Texas Gas Corp.

Units can recover more than 85% of commercially valuable liquids contained in natural gas streams. Direct operating cost in Dryex process for fuel and electricity, according to Delta President Kenneth H. Gayle, Jr., is about 15¢/bbl. Market value is near $3.20/bbl.

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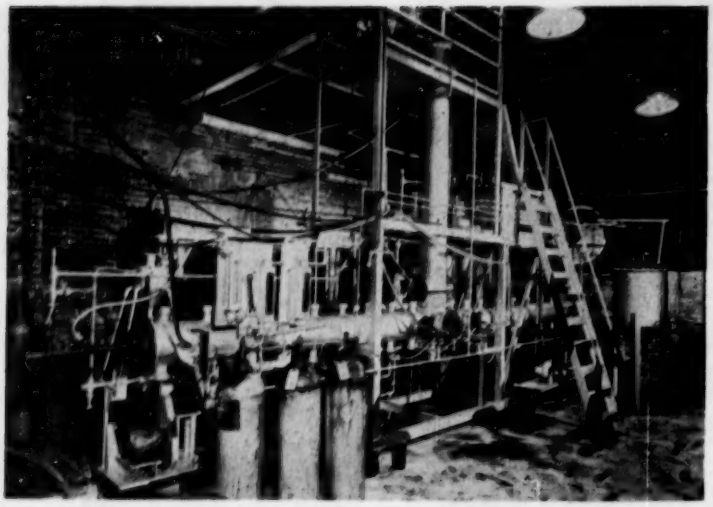
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*The Tri-Sure Trademark is a mark of reliability backed by over 35 years serving industry. †"Tab-Seal" is a registered trademark of American Flange & Manufacturing Co. Inc.

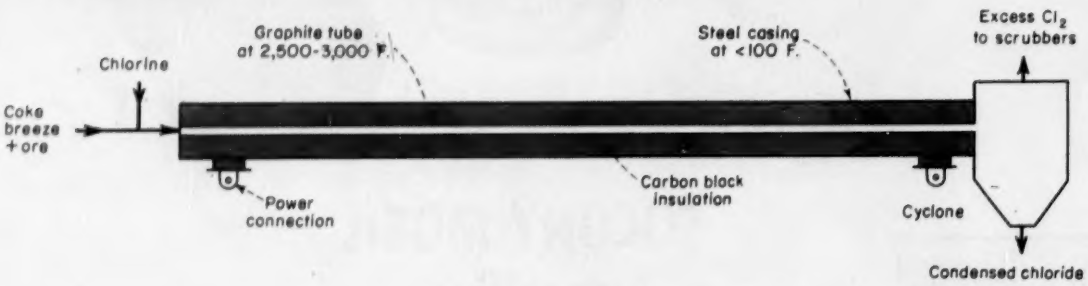
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Graphite reactor tube doubles as resistance element in electric furnace designed for high-throughput production of metal chlorides.



Novel Chlorination Furnace Shows Promise

Continuous tonnage chlorination of the most refractory ores —this is the prospect for an experimental furnace of novel design which Salem-Brosius, Inc., Carnegie, Pa., is now putting through its paces.

Chlorine, coke breeze and an ore—such as chromite, spodumene (lithium), zircon, rutile (titanium), boron oxide or calcium borate—sweep through the horizontal graphite reactor-furnace at velocities of 5-150 ft./sec. Required chlorination temperatures of 2,500-3,000 F. are produced by using the reactor tube as an electrical resistor. In a matter of seconds, Salem-Brosius can get total chlorination of ores at rates of 800-1,000 lb./day with 90% utilization of chlorine.

Other materials slated for early trial runs in the new furnace are columbite, molybdenum oxide, ilmenite, uranium "yellow cake" and titanium-bearing red mud from the Bayer alumina process.

▶ **Chemical Partner** — Chemical industry attention is openly focused on this program now that Diamond Alkali is acquiring a 50% interest in Metal Chlorides Corp., the Salem-Brosius subsidiary doing the research and development work on the chlorination furnace.*

Diamond's first target in its latest diversification venture will probably be chrome ore, already processed successfully in Metal Chlorides' resistor-reactor, although one or more "exotic" materials like boron, titanium and zirconium undoubtedly figure in company plans. (Diamond's agreement doesn't exclude other companies from partnership in the exploitation of this processing tool.)

Metal Chlorides is accomplishing all this with rather modest equipment which, incidentally, is of pretty fair capacity when it comes to dealing with materials like zirconium and boron chlorides.

▶ **Furnace Design** — Heart of the present system is 24 ft. of

* In June 1956 Salem-Brosius acquired Metal Chlorides Corp. in order to combine the former's technical skill and experience as a maker of furnaces and other heat-treating equipment with the latter's original ideas for high-temperature halogenation.



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¾-in.-I.D. graphite reaction tube. Carbon black surrounds this tube, and the whole assembly is enclosed in a 12-in. steel pipe.

Six water-cooled graphite electrodes, fixed tightly by nickel clamps to the reactor tube, deliver 35 kw. of power from arc-welding transformers. Power consumption—about 1,800 kwh./ton ore processed—is quite reasonable, even for the production of metal chlorides lower in price than boron and zirconium.

Salem-Brosius figures it can duplicate the pilot equipment, including necessary accessories, for about $60,000; half this expenditure would be for the reactor assembly and electrodes.

▶ **Holding Hot Chlorine** — Possibly Metal Chlorides' toughest engineering hurdle was the economical containment of chlorine gas at high temperatures. The carbon black blanket around the reactor tube, serving both as electrical and thermal insulation, gets credit for most of this. You can put your hand on the outer steel casing, 10 in. away from temperatures of 3,000 F., without discomfort. Thus, although some chlorine escapes from the graphite tube to permeate the carbon black sheath (graphite is porous at high temperatures), no special materials of construction are needed for the gas-tight metal enclosure.

Cooling the electrodes is necessary, though, to prevent chlorine attack on the nickel clamps. This can be a little tricky, what with the chance of chloride condensation on the clamps (corrosion) and just inside the reactor tube (clogging).

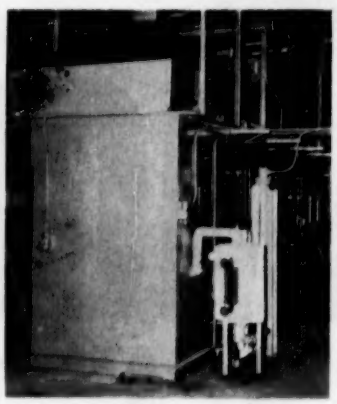
▶ **Purity Problems** — Obviously any iron and aluminum in the ore or coke will be chlorinated and collected with the chlorides of the desired element. Because of these contaminants, zirconium tetrachloride produced by present metallurgy must be treated with hydrogen (to reduce volatile ferric chloride to nonvolatile ferrous) before magnesium reduction. Metal Chlorides claims that its $ZrCl_4$ is sufficiently pure (less than 100 ppm. iron) to be reduced directly to the metal.

Boron ores gave Metal Chlorides some trouble by fusing before reaction (if boron oxide) or by forming a viscous liquid on very slight cooling (if calcium borate). An excess of coke was the answer in both cases, serving to absorb and carry the ore until chlorination is complete.

▶ **For Deashing Coke?**—In the course of its metallurgical work Metal Chlorides has come up with a scheme for deashing coke breeze via chlorination to produce a carbon suitable for graphite nuclear control rods and electrodes for aluminum and magnesium smelting. Everything but the carbon is chlorinated and volatilized.

If coke breeze is available at $4-5/ton, says Metal Chlorides, the new furnace can make pure carbon more cheaply than industry can get it now from petroleum coke.

Collection of chlorinated products is no problem; most condense at ambient temperatures. Metal Chlorides uses a conventional cyclone collector for the job. Only silicon tetrachloride—a byproduct of zircon chlorination—and boron trichloride need refrigeration for condensation following recovery of the accompanying chlorides.



Pilot Plant Makes First Commercial Decaborane

Capacity of American Potash & Chemical's new decaborane pilot plant at Henderson, Nev., is about 1 lb./day. The high-energy fuel is made from boron trichloride and sodium borohydride via diborane intermediate. Decaborane is priced at $600-$800/lb. in research quantities.

News Briefs

Chromyl chloride: Allied Chemical & Dye Corp. has obtained patent covering a new process for producing chromyl chloride. Process involves use of end product as reaction medium.

Lithium perchlorate, nitrate: American Potash & Chemical Corp. is producing lithium perchlorate and nitrate at Henderson, Nev., for use as oxidizers in high-energy fuels.

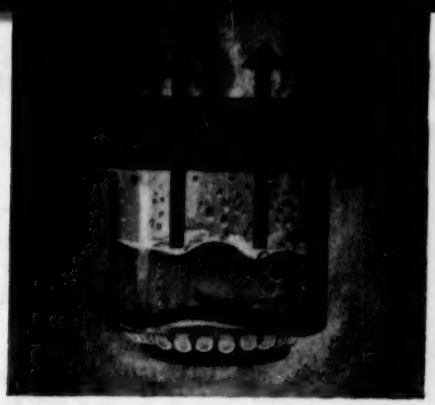
Antiknock compound: Ethyl Corp. reveals that its new antiknock agent, termed AK-33X, is methyl cyclopentadienyl manganese tricarbonyl. New additive has proved most effective with fuels that have good tetraethyl lead response.

Atomic insurance: British insurance market has outlined a scheme to cover land-based atomic power plants throughout the world. British committee has received five foreign inquiries, but none from U. S. firms.

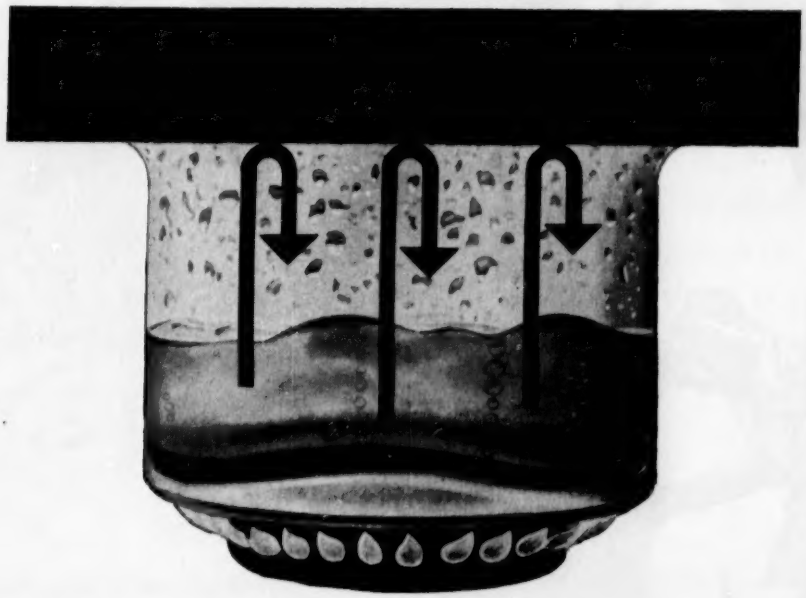
Dimethyl sulfoxide: Union Rheinische Braunkohlen Kraftstoff, near Cologne, Germany, is piloting a method to produce dimethyl sulfoxide, is already building a 100-ton/yr. plant. A versatile solvent, DSO hasn't been produced on a large scale in Germany. (See *Chem. Eng.*, Feb. 1957, p. 108 for U.S. process.)

New element: International research team, working at the Nobel Institute in Stockholm, has isolated atoms of element 102, is considering the name nobellium. Scientists believe, but have not confirmed that it has a mass of 263.

Allylamines: Shell Chemical Corp. has constructed a unit at its Martinez, Calif., plant to make mono-, di- and triallylamines. Chemicals show promise in manufacture of resins, surfactants, rubber chemicals and pharmaceuticals.



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THIS MONTH:

Perfluorocarbon Resin
Teflon-type material for standard extrusion.....176A

Phenolic Compounds
Give molded products extra heat resistance.....176B

Beryllium Oxide Coating
Crucible liner for melting uranium-based alloys.....178A

Vinyl Stabilizer
Endows vinyls with close-to-optical clarity.....178B

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First commercial quantities of vinyl stearate.....184K

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Perfluorocarbon Resin

Teflon-type, adaptable to standard extrusion.

A new material, which supplements the present Du Pont line of Teflon tetrafluoroethylene resins, has a melt viscosity low enough to permit extrusion in standard equipment.

The new resin, called Teflon 100-X, is expected to accelerate the development of applications previously not attempted because of processing difficulties. It is expected to broaden the use of true fluorocarbon resins for such products as jackets for coaxial and multiconductor cable, aircraft and industrial wiring, bottles, liners, electronic components, tubing and packaging for corrosive materials.

Du Pont is considering the manufacture of film from Teflon 100-X.

The generic term, perfluorocarbon resin, has been adopted for Teflon 100-X as an aid in distinguishing it from the Teflon tetrafluoroethylene resins. Both are true fluorocarbons with saturated structures consisting of fluorine and carbon.

The new resin shares the physical, electrical and thermal properties of tetrafluoroethylene resins at temperatures up to 400 F. Tests show it can be used continuously at this level. In comparison, tetrafluoroethylene resin may be used in continuous service at temperatures of 500 F.

Small quantities of Teflon 100-X priced at $19/lb. are now available. Current engineering studies, if successful, are expected to lead to commercial-scale shipments early in 1959.
—Du Pont Co., Wilmington, Del.
176A

Phenolic Compounds

High heat resistance characterizes their molded products.

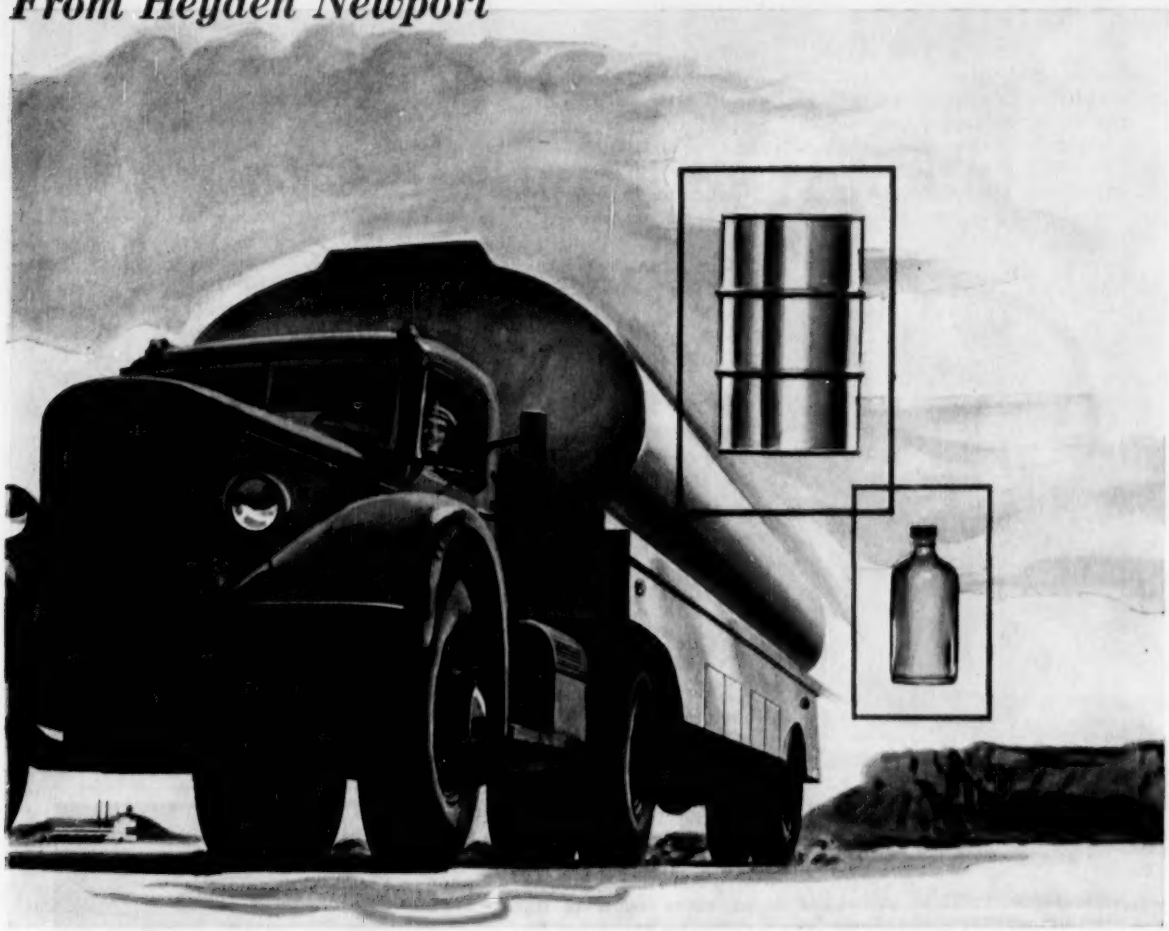
Appliance parts which withstand boiling water and oven-hot temperatures can be molded from two new phenolic compounds.

G-E 12980 produces satin-finished parts which can withstand temperatures up to 500 F. The new high-heat-resistant powder can be molded under temperatures ranging from 300 to 370 F., using standard molding pressures.

A second new molding powder, G-E 12981, is a medium-heat-resistant material. Engineered to resist temperatures up to 400 F., it is suggested for industrial applications such as circuit breakers, cord connectors and thermostat knobs where strength and easier moldability are required.

The low specific gravity of both materials has combined

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with rapid cure, fast preheat cycles and good dimensional stability to demonstrate appreciable molding economies in early field trials.—**General Electric Co., One Plastics Ave., Pittsfield, Mass.** 176B



BeO Coating

Crucible coating stands 1,600 C. melting of U-base alloys.

Graphite crucibles utilized in melting uranium-base alloys for nuclear applications are now being coated with beryllium oxide to prevent carbon contamination of the melt when temperatures go above 1,600 C.

In uncoated crucibles, carbon pickup may be as much as 1%, whereas the carbon content can be held to about 100 ppm. using the beryllium-oxide-coated crucibles. Above 1,600 C., coatings of zirconium, magnesium or aluminum oxide flake off the crucibles, with subsequent carbon contamination of the melt.

Use of a beryllia wash, in addition to preventing contamination, provides increased life for the crucibles. The wash consists of high-purity beryllium oxide powder mixed with water and a binding agent. An oxide coating about 0.025 to 0.030 in. thick is obtained.

Thus far, the wash has proven to be an excellent coating for melting the uranium-niobium and uranium-molybdenum type alloys. It has not proven suitable for melting the uranium-zirconium alloys if the zirconium content is over 4%.—**Beryllium Corp., Reading, Pa.** 178A

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Vinyl Stabilizer

Vinyls stabilized with new compound approach optical clarity.

New vinyl stabilizer, a liquid barium-cadmium compound, is completely free of the fatty acids and octoates present in most such compounds. Absence of fatty acids enables producers to make vinyls of maximum clarity without pick-up of color or yellowing which is common to many systems during calendering and extruding at high temperatures. Called Thermolite 112, it also makes possible the manufacture of pigmented vinyls with outstanding initial color and no color drift during processing.

Clear vinyls stabilized with Thermolite 112 approach optical clarity, have outstanding heat and light stability and provide heat-sealing and printability characteristics unapproached in other barium-cadmium systems.

According to the manufacturer, so powerful is the stabilizing action of Thermolite 112 that in many cases small quantities can be used, resulting in lower costs.

Plate-out on calender rolls is also reduced to a minimum in production of clear vinyls and eliminated in most pigmented formulations. In addition, it provides increased water resistance and lower hazing.—**Metal & Thermit Corp., Rahway, N. J.** 178B

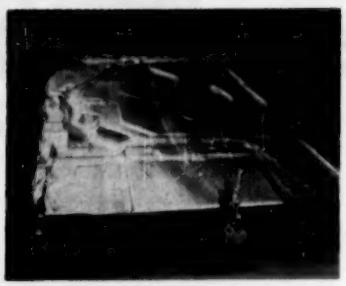
Deicing Film

For aircraft windshields, tin-doped indium oxide.

An ice and fog preventive coating for aircraft windshields, giving better visibility than any previous coating, has been developed for the Air Force by Battelle Institute.

The electrically conducting coating, a tin-doped indium oxide film, has a light loss of only 15 to 20%, which can be reduced to 12% by use of anti-reflective coatings and can be produced at temperatures lower than previously required.

Indium oxide films also may be adapted for uses other than windshields. Since relatively low temperatures are employed in the coating process, these films show promise for application to various classes of thermally unstable materials.—**Air Research & Development Command, P. O. Box 1395, Baltimore, Md.** 178C



Plastic Blankets

For high-temperature vacuum bonding of metal aircraft assemblies.

In the bonding of metal assemblies with phenolic-based adhesives to fabricate wings, fuselage sections, etc., the practice of preparing the lay-up on a metal platen and subsequently blanketing the section with some type of rubber or plastic sheeting to utilize autoclave pressures has become commonplace.

A new polyvinyl alcohol sheet, developed by the plastics division of Reynolds Metals Co. working in conjunction with the industrial engineering staff of Fairchild Aircraft Div., Hagers-



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If you are a processor of such olefins as soya bean oil, cottonseed oil, tall oil, turpentine, linseed oil or unsaturated petroleum derivatives, have you considered epoxidation or hydroxylation with hydrogen peroxide as a means of upgrading them into higher profit products?

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Allied Chemical

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ALLIED CHEMICAL & DYE CORPORATION
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Please send me without obligation your description and review of the epoxidation-hydroxylation processes and bibliography of technical data.

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town, Md., is said to be superior to conventional blanketing materials:

It will withstand temperatures ranging as high as 500 F. and pressures in excess of 200 psi. It conforms to most complex curves, sharp corners or acute shapes without tearing or abrading and holds an excellent vacuum for many hours. —**Reynolds Metals Co., 2500 South Third St., Louisville, Ky. 178D**

Hewitt-Robins, Inc., has developed a silicone blanket 6 ft. wide and 30 ft. long for use in high-temperature vacuum bonding of epoxy resins in aircraft. It is the largest unsupported silicone blanket ever made and permits bonding of larger airplane surfaces than heretofore possible.

Silicone blanket in this width costs $36.40/linear ft., will undergo 60-70 bonding cycles at 350 F, half that number at 500 F. — **Hewitt-Robins Inc., Stamford, Conn. 180A**

Silicon Chemical

New monomer copolymerizes to yield unusual new plastics.

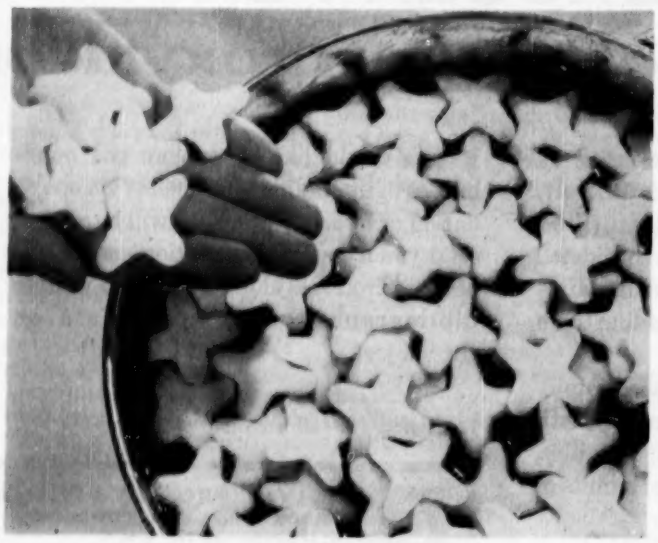
The first of a new family of silicon chemicals, pentamethyl disiloxane methyl methacrylate, can be copolymerized with acrylonitrile, styrene, vinyl acetate and methyl methacrylate by conventional organic methods to yield plastics with unusual properties.

Preliminary tests indicate that the compound, called Syl-Kem 21, may be utilized to prepare new organic polymers with unusual bonding properties and surface characteristics. A 30% copolymer with methyl methacrylate, for example, exhibited a coefficient of friction against steel of 0.03, as compared to 0.05 for polytetrafluoroethylene and 0.15 for polystyrene.

The new compound is likely to undergo many of the reactions typical of methyl methacrylate. Whenever strongly alkaline or acid catalysts are required, however, siloxane rearrangement will take place to some extent. Copolymerization studies of Syl-Kem 21 with methyl methacrylate, styrene, acrylonitrile and vinyl acetate indicate that it is nearly identical to methyl methacrylate in polymerization rate and in copolymerization behavior.

In contrast with vinyl-silicon compounds, it is readily polymerizable in bulk, emulsion or suspension. Conventional initiators such as benzoyl peroxide will yield high-molecular-weight polymers. Molecular weights of polymers prepared in bulk range from 600,000 to 700,000.

Called Syl-Kem 21, the monomer is a clear liquid with a boiling point of 86.5 C. at 10 mm. and a density of 0.903. Soluble in hydrocarbons, ethers and alcohols, it is currently available in pilot-plant quantities.—**Dow Corning Corp., Midland, Mich. 180C**



Floats of Polyethylene Blanket Solution Vapors

New miniature floats called Mini-Vaps reduce evaporation losses of volatile solutions by as much as 75%. Made of foamed Tenite polyethylene, buoyant floats are practically immune to breakage or puncturing in use. Four-pointed design facilitates tight clustering and interlocking on the solution surface.

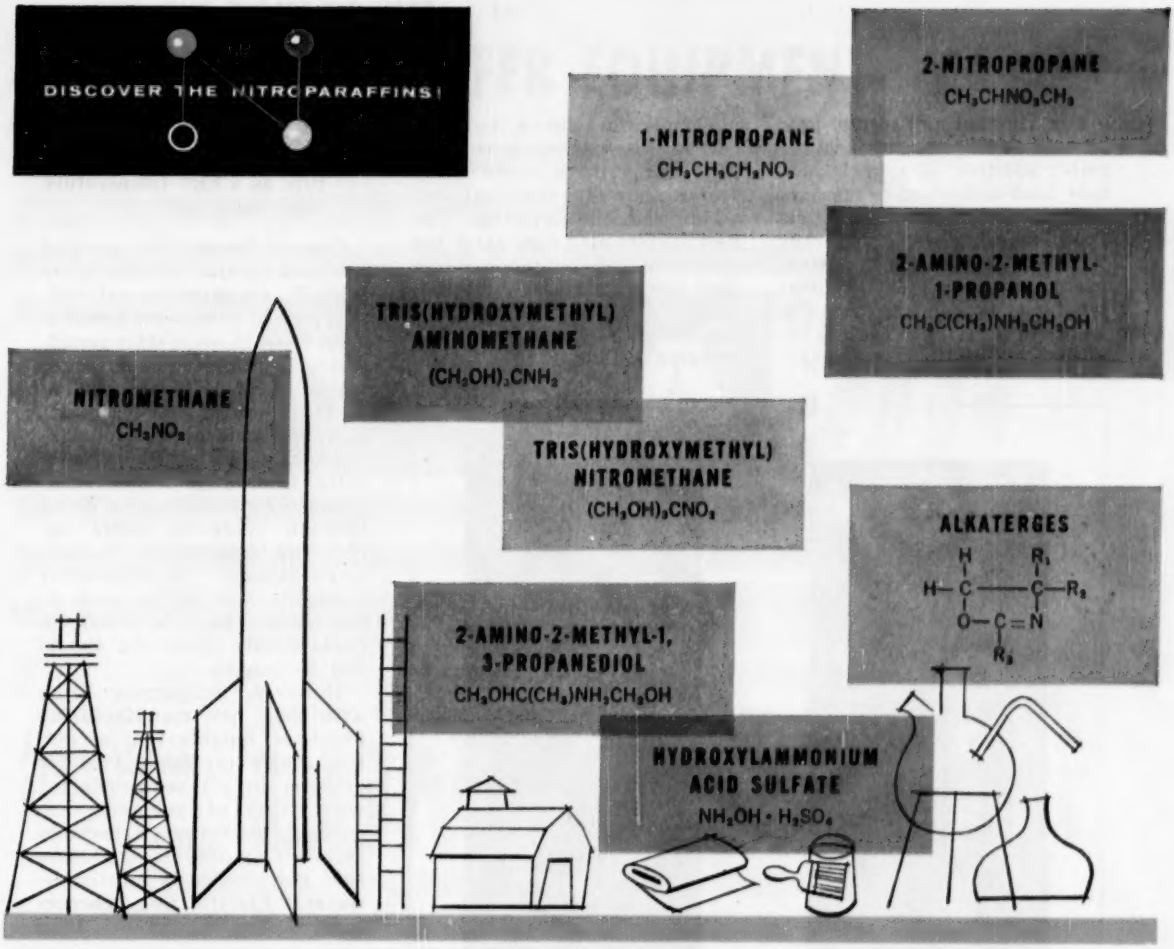
They also have polyethylene's outstanding chemical and solvent resistance, neither contaminate a solution nor are affected by it.—American Agile Corp., Box 168, Bedford, Ohio. 180B

Refrigerant for Heat

New use in radiation heating adds to refrigerant, aerosol uses.

A cold vapor heating system, in which a gas normally used as a refrigerant is piped through radiator coils in place of water, may provide a new and better method of heating buildings that need only intermittent service.

The system, which already boasts European installations, resembles the usual hot water or steam radiator heating plant in operating principle. Major differences: substitution of an agent like Du Pont's Freon-114 dichlorotetrafluoroethane



NP's ECONOMY AND EFFECTIVENESS UTILIZED BY INDUSTRY FOR EXPANDING LIST OF PRODUCTS!

Utilization of Nitroparaffins and their derivatives is being expanded each day by a host of progressive manufacturers.

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—a refrigerant and aerosol propellant—for water in heating coils; addition of a shell-and-tube heat exchanger to the normal coal, oil or gas-fired boiler. Pipes carrying the refrigerant through the radiation system pass through a heavily insulated heat exchanger. There hot water or light mineral oil vaporizes the refrigerant.

Temperature in a building can be raised as much as 34 F. in 1¼ hr., six to seven times faster than conventional hot water radiation heating. The new system also eliminates the danger of freezing pipes during shut-down periods.—**International Carbonic Engineering Co., Delaware Trust Bldg., Wilmington 1, Del. 180D**





Now It's Foamed-in-Place Phenolics

By learning to control the well-known foaming properties of phenolic resins when mixed with acid catalysts, Bakelite has succeeded in producing relatively low-cost, fast-setting wall insulation. Foamed in place within narrow cavities that simulate space between studs in a wall, phenolic begins foaming almost as soon as ingredients are mixed and poured (above left). Complete reaction from mixing to permanent foam is completed in about 60 sec. (above right). Key is in achieving proper reaction speed; foam must set as it rises; otherwise density may vary from top to bottom.

Total material cost of foamed phenolic insulation is relatively low (phenolic resin base costs about 33¢/lb.; vinyls, 30¢/lb.; styrene, 45¢/lb.; urethane, 51¢/lb.). Insulating properties of phenolic foam at a density of about 2 lb./cu. ft. are said to compare favorably with the most expensive insulating materials available commercially.—Bakelite Co., 260 Madison Ave., New York 16, N. Y. 182A

Semiconductor

SiC may have a good future as a high-temperature semiconductor.

General Electric has operated a silicon carbide rectifier up to 1,200 F. An experimental unit, it is part of company's development work on solid-state rectification at high temperatures which promises to play an important part in many aircraft and electronic applications.

Thus, use of compounds, rather than single-element semiconductor materials, may break through operating limits imposed by temperature. Current single-element semiconductor materials, like silicon now on the market, have been able to operate only up to the 400 to 500 F. range.

However, compounds bring with them new manufacturing problems, notably that of getting single crystals. A major problem in all semiconductor work, that of achieving extremely pure materials, becomes increasingly difficult when more than one element is involved.—**General Electric Co., Schenectady, N. Y. 182B**

Boron Chemicals

Manufacturer's new capacity includes first commercial BBr_3.

American Potash & Chemical Corp. is producing two new boron chemicals—boron trichloride and boron tribromide—at its Los Angeles plant. This marks the first time boron tribromide has been produced on a commercial level.

Boron trichloride, a gas, and boron tribromide, a liquid, can be used in producing elemental boron and as intermediates or raw materials for the manufacture of other boron compounds such as diborane and sodium borohydride. Also they both can be utilized in halogenation reactions and as catalysts in certain processes. In addition, boron trichloride is suitable as a fire-extinguishing agent for magnesium fires.

Cost of boron trichloride in tonnage quantities will be at

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YUBA HEAT TRANSFER DIVISION

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Important to every user of heat transfer equipment is the acquisition of the Heat Exchanger Division of The Lummus Company by Yuba Consolidated Industries, Inc. The management, sales and engineering personnel, as well as the designs, patents, and manufacturing facilities of the former Lummus operation at Honesdale, Pennsylvania, are now part of the YUBA nation-wide organization. YUBA is proud of the opportunity to identify its name with the long established recognition enjoyed by Lummus in the power industries, as well as in the chemical and petroleum processing fields. The continuing pioneering development for which Lummus has been known, and its existing commitments and obligations, will be carried forward in every phase under the YUBA name. For your current and future requirements consult YUBA first.

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$1.60/lb. as contrasted to the present market price of $3/lb. Reduced price was made possible by a semicontinuous company-developed production process. Further price reductions are anticipated as production volume increases. — **American Potash & Chemical Corp., 3030 West 6th St., Los Angeles 54, Calif.** 182C

BRIEFS

Methyl isopropyl catechol, low-cost, efficient stabilizer for use in synthetic rubber and plastics manufacture and one of the company's series of new turpentine-based products, is about to go into commercial production. Product is also expected to have wide application as an antioxidant for vegetable oil, gasoline and other petroleum products. —**Heyden Newport Chemical Corp., 242 Madison Ave., New York, N. Y.** 184A

Dimethyl acetal, a source of acetaldehyde in situ, can be used instead of methyl vinyl ketone. Made by British Industrial Solvents of England, it is now distributed in the U. S. High-purity meta-toluylene diamine, used in direct dyeing of fur and leather, is newly available from the same U. S. source.— **Aceto Chemical Co., 40-40 Lawrence St., Flushing 54, N. Y.** 184B

Metal pretreatment coating has a 450 F. flash point which makes it particularly adaptable for hot castings. Basic ingredient is rice oil, said to have superior penetrating and adhering qualities. Called Bindox and available in three grades, it is said to be suitable for applications ranging from a wrist watch to a battleship.—**Guardian Chemical Products, 2110 Chartres St., Houston, Tex.** 184C

Trimethoxyboroxine, new liquid compound containing 18.7% boron, is now in commercial production. High boron content is expected to give wide usage as a chemical intermediate. It is currently used in testing special engines, as an ingredient in paint formulations, as a fire extinguisher fluid. — **Anderson Chemical Co., Weston, Mich.** 184D

Modified acrylic molding powder called Implex has been put on the market. It was developed to provide greater toughness and impact strength, combined with the general stability characteristics of acrylics, at a price in the range of medium-cost molding materials. Valve parts and numerous housings are among target applications.— **Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.** 184E

Fabrics finished with a new low-cost cellulose reactant called Warcoset LCR are said to have improved crease resistance, greater shrinkage and stretch control than those treated with conventional resins. Formulated with a low free formaldehyde content, the product is a clear liquid resin.—**Sun Chemical Corp., 10-10 44th Ave., Long Island City, N. Y.** 184F

Fine-sized silica gels have been found practical for application in the formulation of adhesives by a series of extensive tests. Increased bond strength was found to result through use of two of company's Syloid line of gels: Nos. 75, 244.—**Davison Chemical Co., Baltimore 3, Md.** 184G

Titanium sponge price has been reduced 50¢/lb. in three grades made by Du Pont. Subsequently, Titanium Metals Corp. has announced price reductions averaging 10% on mill products such as billets for which titanium sponge is the basic material. Last December, Titanium Metals reduced mill products between 6% and 8%. A few days later, Du Pont cut titanium sponge by as much as 25¢/lb. — **Titanium Metals Corp. of America, 233 Broadway, New York, N. Y.; Du Pont Co., Wilmington, Del.** 184H

To remove rust, scale and corrosions, new powdered acid material is said to offer greater safety on aluminum, brass and galvanized surfaces than conventional liquid products. Other advantages include ease in shipment as it requires no returnable carboys, mild odor and nonfuming characteristic. Called Oakite Drycid, it is added to water in concentrations upwards of 8 oz./gal.—**Oakite Products, Inc., 157 Rector St., New York, N. Y.** 184I

Polymerized ethyl silicate is now being made by Monsanto in the United States, and an exclusive contract with a distributor to the investment casting industry has been arranged. Additional use for the compound looks promising in high-temperature refractories as a binder, in treatment of graphite molds, in a refractory wash for furnace linings, for application to stone or ceramic surfaces to retard weathering.— **Monsanto Chemical Co., St. Louis 4, Mo.** 184J

Vinyl stearate will be produced in commercial quantities for the first time in the United States by the end of this year. New Calvert City, Ky., plant will have a 2-million-lb./yr. capacity. Vinyl stearate-vinyl acetate copolymers make excellent vehicles for exterior emulsion paints, giving a tough, flexible film with high water resistance.—**Air Reduction Chemical Co., 150 East 42nd St., New York, N. Y.** 184K

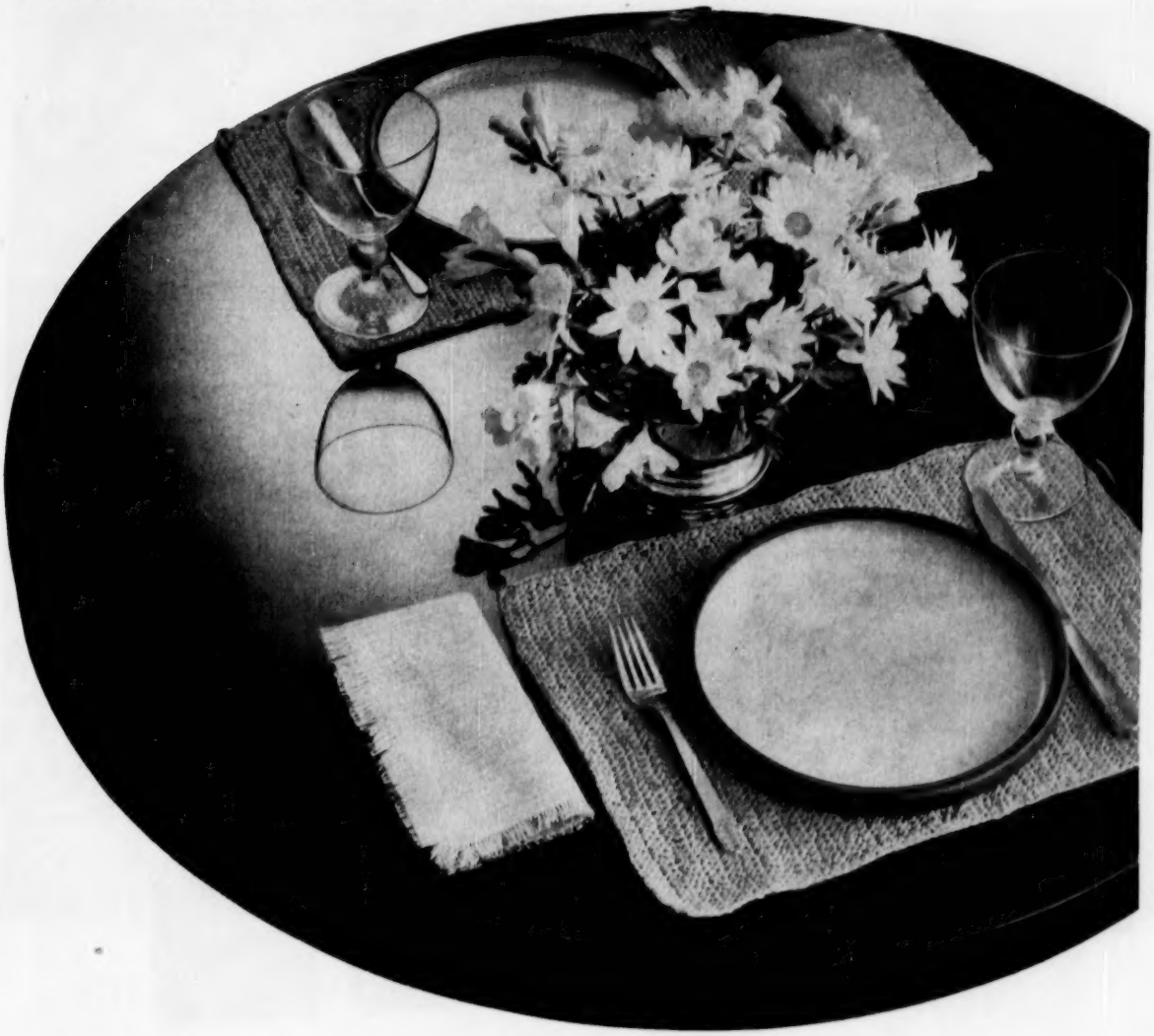
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Enjay petrochemicals play an important role also in the formulation of many other surface coating products, such as vinyl lacquers, water-base paints, enamels, and paint and varnish removers.

The modern, well-equipped Enjay Laboratories have recently been expanded and are at your service in the application of any Enjay petrochemical. Call or write for further information.

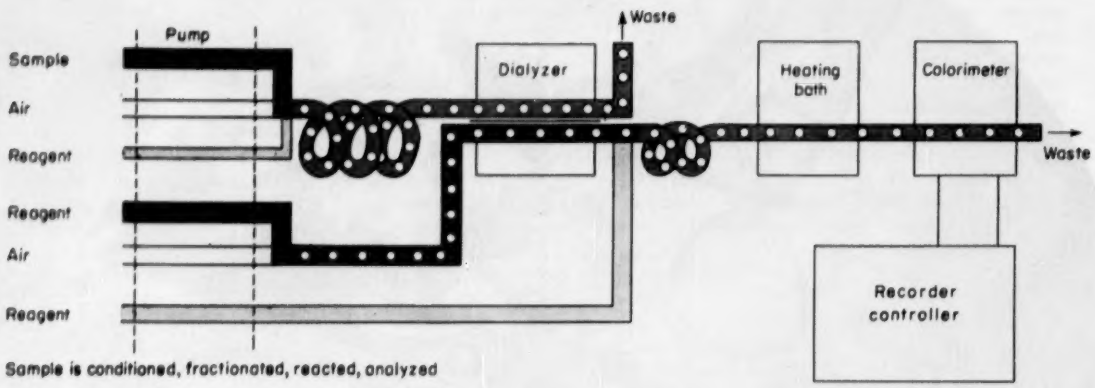
Enjay offers a widely diversified line of petrochemicals for industry:

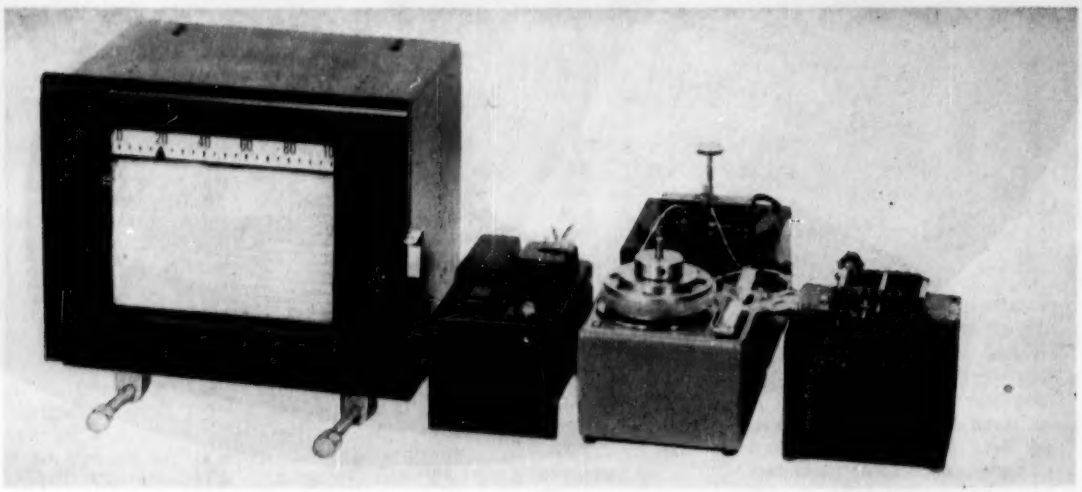
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Chemical Control of Process Now Automated

For the first time, process streams are chemically analyzed on a continuous dynamic basis that gives a running record and controls automatically.

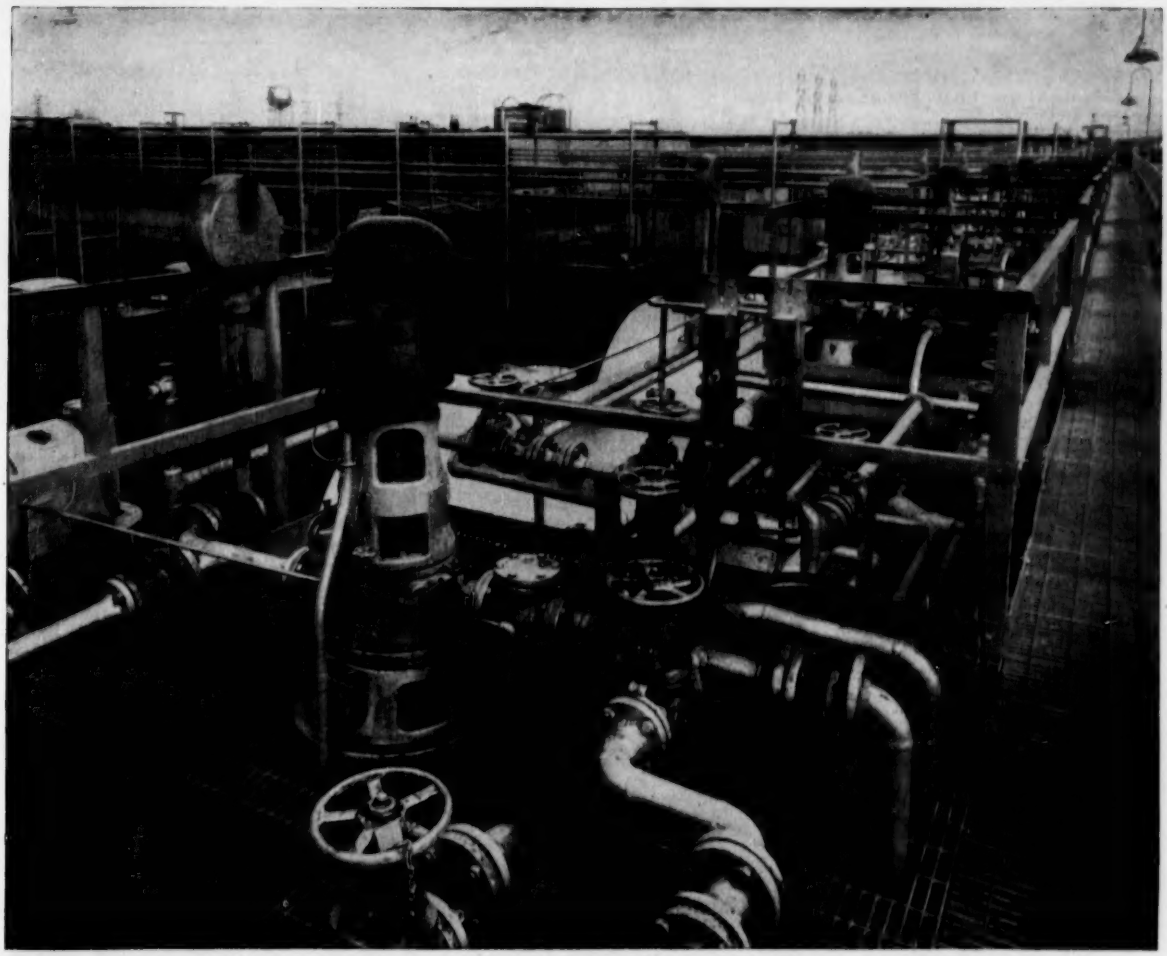
MANY a plant chemist will sigh with relief and tackle that long-deferred development project, if the Technicon Autoanalyzer lives up to its early promise. With an uncanny precision born of our automated age, it chemically analyzes a flowing sample of process stream, records continuously and controls within preset limits.

While instruments such as the mass spectrometer, infrared analyzer and vapor fractometer have been opening up wide new areas of process control, the Autoanalyzer is reported the first successful stream analyzer based entirely on chemical analysis.

Not only can the Autoanalyzer replace the control chemist but it actually can surpass many of his achievements. Elapsed time for analysis can be as short as 1½ min.

Analytical results can be reproduced within 1% states E. C. Whitehead, Technicon Vice President. And the system can determine smaller quantities than is possible manually.

▶ **Covers Broad Range**—You



After nine years and thirty million gallons...

This plant of B.F.Goodrich Chemical Company at Avon Lake, Ohio, went into operation in 1948. There were 12 LaBour Type G pumps in the original installation, and by conservative estimate they have pumped something like 30,000,000 gallons of alcohol, plasticizers and blending liquids. All are still on the job 24 hours a day, and total repairs for the lot consist of a few bearing replacements. Since Type G is a packingless pump there has been no packing expense.

When a recent expansion was planned to add materially to the capacity of the plant it was decided not to buy any more pumps. The nine-year-old LaBours had demonstrated such dependability and were in such good condition that they could be trusted to handle the increased responsibility without help.

If you're looking for real economy in pumping, consider this typical LaBour performance record. Difficult jobs and difficult liquids make it even more profitable to assign the task to LaBour. Ask us to prove it.

LABOUR

Equipment Cost Indexes, p. 188

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Heat Meter 190B
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Hydrostatic Tester 190D

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can look for possible application of the Autoanalyzer on any constituent of a sample that will undergo a chemical reaction to produce a colored product. Intensity of color in the product will be a linear function of the concentration of measured constituent present in the sample.

Compared colorimetrically against a known standard, the color initiates a null-balancing action by a ratio-recording potentiometer. With this type of action there is no problem of absolute measurement, so that there is great flexibility in what the system can do.

▶ **Present Status** — Before the first commercial models were delivered to customers in June, six prototype models operated in the field for 18 mos. Now, several pharmaceutical houses are working actively on use of the Autoanalyzer system in their manufacturing processes. Sugar refineries, distilleries, pulp mills and electroplaters are among others now taking a hard look at how they can use this technique to cut costs and produce better products.

▶ **Tool to Improve Process**—Because the Autoanalyzer is dynamic, it charts process changes as they develop. While this makes for much better control of existing processes, it also leads to improvements.

Take a batch process such as fermentation, for instance. By pinpointing where in the time cycle certain stages occur, the Autoanalyzer gives a firm basis for changing conditions to improve the process. End result may be an equivalent or better yield in less time.

▶ **Train of Events**—Sample material and reactants enter the system in proportional quantities. The constituent to be measured is transferred from the sample stream to a reaction stream by dialysis.

After mixing thoroughly, the reaction stream is conditioned at optimum temperature to develop full color before being measured in the colorimeter.

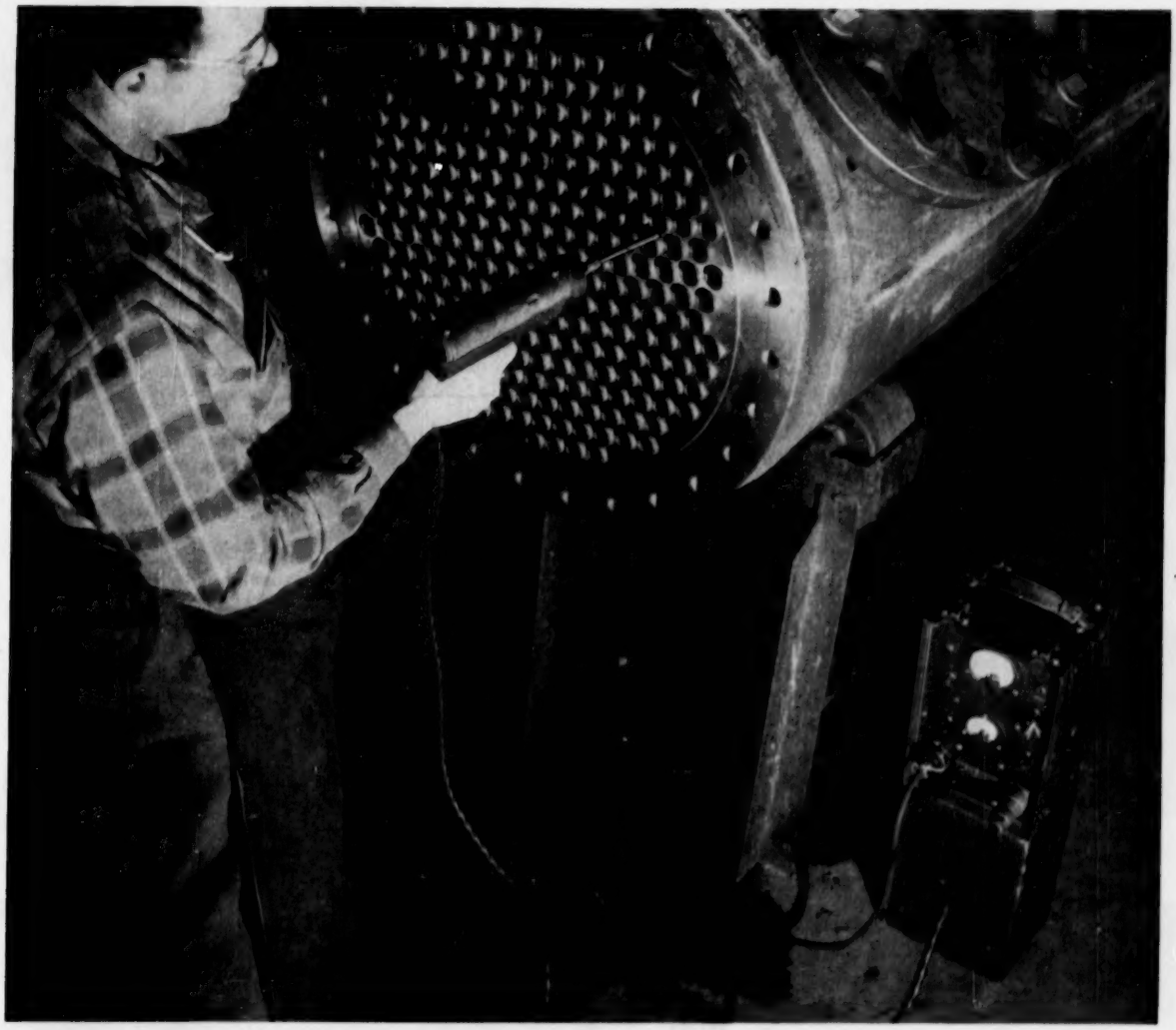
System which carries out these operations is a series of modular elements. Air, sample and reactant are aspirated into system through lengths of plastic tubing. Cross sectional bore of each tube is selected to provide the required proportional volumetric flow, since linear flow is equal in all tubes.

All tubes run parallel to each

Equipment Cost Indexes

	March 1957	June 1957
Industry		
Avg. of all	222.2	224.1
Process Industries		
Cement mfg	213.1	215.3
Chemical	223.3	225.5
Clay products	207.0	209.2
Glass mfg	210.9	213.0
Paint mfg	214.8	216.6
Paper mfg	215.2	217.3
Petroleum ind	219.3	221.1
Rubber ind	222.1	223.9
Process ind. avg	220.7	222.8
Related Industries		
Elec. power equip	225.6	228.4
Mining, milling	224.7	226.9
Refrigerating	250.9	253.0
Steam power	210.3	212.0

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124–6 for method of obtaining index numbers; March 1957, pp. 266–7 for annual averages since 1913.



LEAK DETECTION . . . another reason why you get more for your dollar with p-k heat exchangers

The man above is "snooping" around a P-K heat exchanger to make sure it is leak free. The instrument he's using is an extremely sensitive leak detector which picks up even the slightest trace of a gas or vapor leak. For example, it can detect a leak so small that it would take a year for 1/100 of an ounce of gas or vapor to escape without discovery.

This leak detection test is only one of the many fabricating and testing procedures that make P-K heat transfer equipment the best you can have. For another example, every weld is x-rayed so that any flaw can be eliminated; each tube end is expanded electronically for the most perfect fit. Each unit's thermal rating is scientifically checked to assure that it will perform exactly at its rated capacity.

Precautions like these are the reasons why more and more processors, engineers and contractors are turning to P-K for their exchanger needs. P-K invites your inquiries about the design and fabricating of heat exchangers. Write, phone or visit The Patterson-Kelley Co., Inc., 169 Burson Street, East Stroudsburg, Pa.

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other across a flat, spring-loaded bed on the pumping module. Pumping action occurs when rollers move across the bed and squeeze the tubes forcing the contents to move in the same direction. All tubes have the same wall thickness so that they are squeezed equally by the rollers.

Streams from the pumping module flow to the dialyzer module. Here, diluent, air and any special treating chemical join the sample stream. Then, diluent, treating chemical and sample pass through a coiled tube which assures complete mixing. Leaving the coil, stream enters the dialyzer.

Either a stream of reactant or distilled water enters the other channel of the dialyzer to pick up the material which diffuses through the membrane from the sample stream.

Sample stream which leaves the dialyzer discharges to waste. Reactant stream, containing the constituent to be measured, may be joined by one or more additional reactant streams before it enters a mixing coil followed by a hot-water-jacketed coil in another module.

From the jacketed coil, the stream enters a vented chamber where air is released prior to passing into the colorimeter.

▶ **Air Is Vital** — Liquid flows through the mixing coils, dialyzer and heating bath as slugs, separated by slugs of air. Reason is to prevent back mixing and to provide clear-cut indication of change in the sample stream. Also, the air bubbles keep the tubing walls wiped clean.

In the event that more than one component of the sample stream diffuses through the dialyzer membrane, it is usually possible to select a reactant that will be specific for only one of these components.

Many times, two or more different analyses must be determined. Applications of this type may be satisfied by linking together the combination of modules that will provide the required information. Actually, with the proper combination of modules and selection of good color reactions, Technicon feels that the Autoanalyzer can handle most stream analysis and monitoring problems.—**Technicon Instruments Corp., Chauncey, N. Y.** 186A

Control System

All components to control or position element.

Furnished as a packaged system, the Series 300 control is reported ideal for any application that requires automatic positioning, indication and remote control. It is used with many final control elements including cone, butterfly, plug, ball and sliding stem valves; throttles, rheostats and other variable speed mechanisms.

Controller attaches readily to any final control element. A flexible connection between valve and controller is all that is required for position feed back. Controller output supplies a double-acting cylinder on the final control element.

Supervisory control can operate at distances from a few feet to many miles. Response speed of electronics has been combined with the smoothness of pnuematics and hydraulics at the positioner.—**A W. Cash Co., P. O. Box 551, Decatur, Ill.** 190A

Heat Meter

Measures heat transferred by flowing stream.

Change in the heat content of flowing liquids is measured and indicated by the recently announced Pollux Btu. meter. It provides a reliable check on process heat transfer.

Data is produced by the teaming of a flow meter, temperature pickups and an integrator. Difference in supply and return liquid temperatures is integrated with flow rate to give change in heat content reported as Btu. on a totalizer.

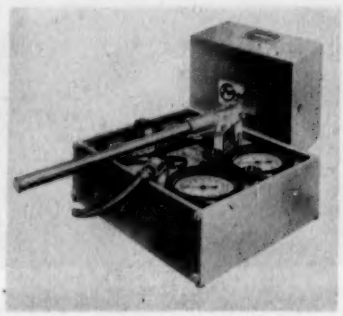
Total number of gallons is recorded on a second counter. Directly above the counters is a pointer that indicates instantaneous temperature difference between supply and return lines.—**Air Conditioning Equipment Corp., 214 E. 44th St., New York, N. Y.** 190B

Pneumatic Controller

Ideal for varying time constants and short-span measurement.

New both in concept and execution, the Transcope pneumatic controller provides an extremely accurate, compact means of maintaining a given set point. It uses the motion-balance principle uniquely through interconnected multiple bellows and springs acting on a common force plate.

Primarily, the Transcope controller is intended for use on the back of panel boards. Plug-in design makes possible mounting to a separate manifold located either at the point of measurement or the point of control. An integral cut-off relay makes this possible. Unit parts are completely interchangeable. — **Taylor Instrument Co., Rochester 1, N. Y.** 190C



Hydrostatic Tester

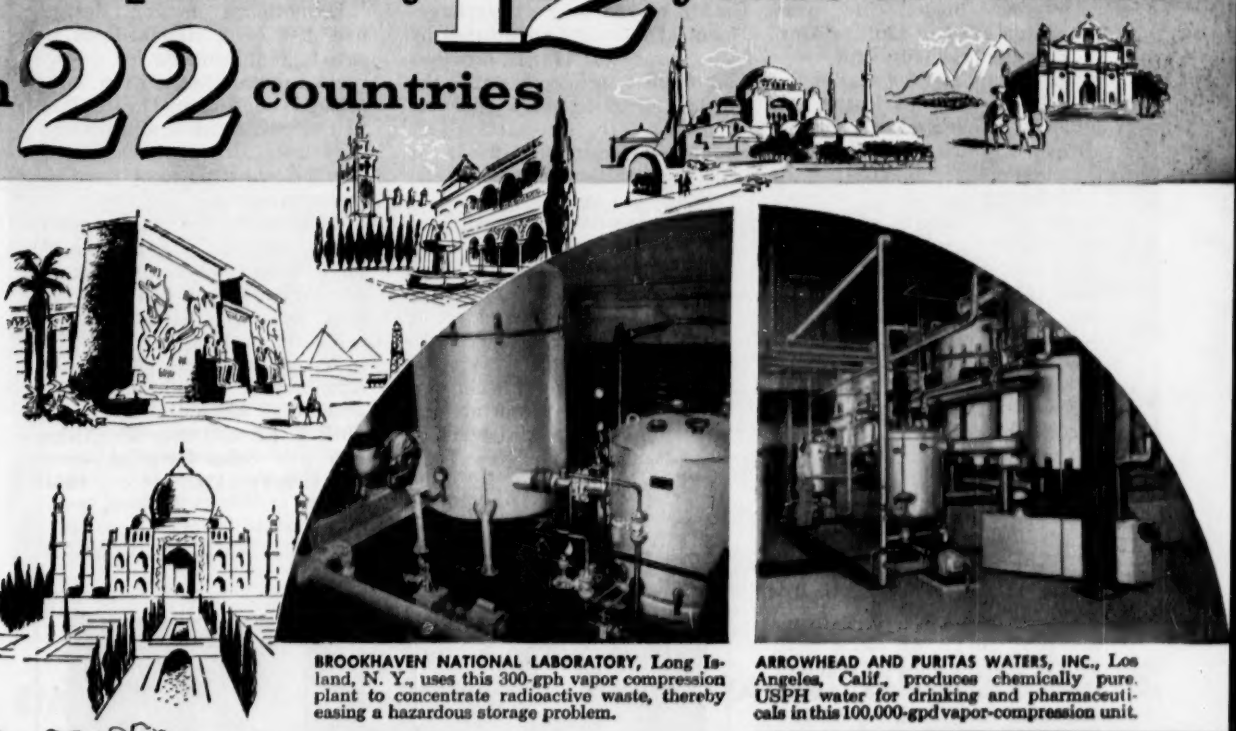
Portable unit for field testing of systems.

Weighing only 50 lb., the utility version of the new Farris Porta-Tester hydrostatically tests valves, pressure vessels, piping, steam generators, pump cases and other process equipment up to 3,000 psi. It can be used with water or other hydraulic fluids.

Since the Porta-Tester measures only 18 x 14 x 8 in., it can be carried about like an overnight case. Unit is complete with four test gages and 8 ft. of flexible tubing that coils on the rear of the cover. The pump handle folds flat in the case—**Farris Engineering Corp., 501 Commercial Ave., Palisades Pk., N. J.** 190D

CLEAVER-BROOKS
VAPOR COMPRESSION EVAPORATORS

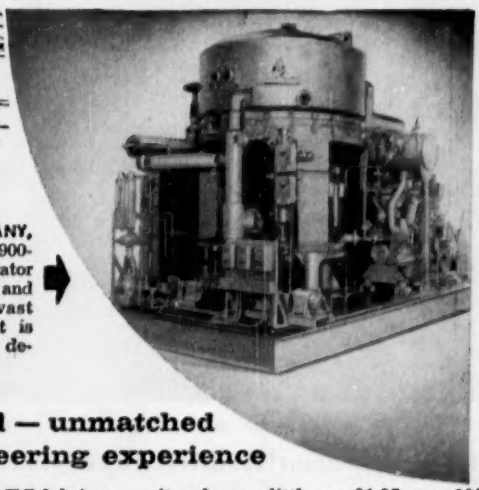
Field-proved by 12 years of service in 22 countries



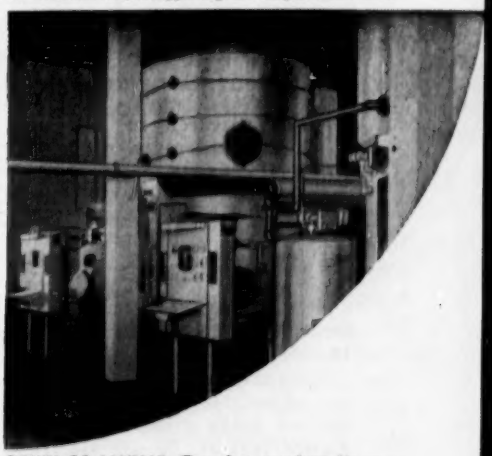
BROOKHAVEN NATIONAL LABORATORY, Long Island, N. Y., uses this 300-gph vapor compression plant to concentrate radioactive waste, thereby easing a hazardous storage problem.

ARROWHEAD AND PURITAS WATERS, INC., Los Angeles, Calif., produces chemically pure, USPH water for drinking and pharmaceuticals in this 100,000-gpd vapor-compression unit.





SAHARA PETROLEUM COMPANY, Alexandria, Egypt, employs a 900-gph vapor compression evaporator of this type to supply drilling and exploration camps with vast amounts of fresh water. Unit is typical of complete "packages" delivered to installation site.



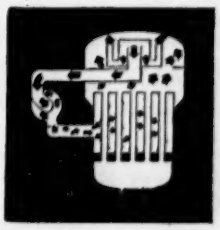
TOWN OF SALINAS, Ecuador, receives its entire residential fresh water supply from two 2100-gph vapor compression evaporators. This life-saving water supply (100,000 gpd) saved the town from being abandoned.

Leader in its field — unmatched application engineering experience

An oil camp in Egypt...an AEC lab in Long Island . . . a pharmaceutical plant in California...a coast town in Ecuador. *Just four of thousands* of Cleaver-Brooks vapor compression evaporators that are proving the economies of highly efficient operation.

Drawing from any raw water supply, sea water or even radioactive waste — these thoroughly field-tested units automatically produce distillate of highest purity, for as little as $1.25 per 1000 gallons of potable water.

Cleaver-Brooks is widely recognized as a leader in evaporation engineering — consistently solves pure water problems . . . with equipment designed for *most economical* operation. In addition to vapor compression evaporators, users also have a choice of multi-effect, flash and waste heat units in a wide range of capacities.



Vapor compression, the world's most efficient evaporation plant

Latent heat is constantly reclaimed by the compressor or "heat pump" and recycled through the evaporator. Up to 300 pounds of fresh water can be produced for every pound of diesel fuel used. Electric and steam-driven units consequently are economical to operate.

Cleaver Brooks

BUILDERS OF EQUIPMENT FOR THE GENERATION AND UTILIZATION OF HEAT AND POWER

For complete details, write . . .

CLEAVER-BROOKS COMPANY, *Special Products Division*
365 E. KEEFE AVE., MILWAUKEE 12, WIS., U. S. A.

Cable Address CLEBRO—Milwaukee—all codes

Air Preheater

Saves boiler fuel and reduces smoking.

Low-cost Boston air preheater installed in the fire door of a boiler reduces fuel consumption up to 25% and cuts smoke and soot markedly. It supplies preheated secondary air over the fire bed or burners for maximum combustion.

Preheater consists of two basic sections: an adjustable air intake valve that extends outside of the fire door; and a preheating chamber mounted on the inside of the door. Air drawn through the intake by the normal boiler draft circulates through a labyrinth of hot surfaces inside the preheating chamber before it flows evenly over the fire bed or burners.

Boston air preheater can be used with low- or high-pressure, oil-, coal-, or coke-fired boilers of the induced-draft, forced-draft or steam-blast type. It has been thoroughly proven out in Europe during the past 10 yr. on more than 50,000 installations—**Preheater Corp. of America, 415 Lexington Ave., New York 17, N. Y.** 192A

High-Heat Source

For research in extreme high-temperature range.

Plasmatron, a source of 15,000-K.heat, now is commercially available for scientific research where extremely high temperatures are required. It produces and maintains a continuous, controllable temperature up to 15,000 K.

Heat source is the plasmajet, an adjustable gas jet using various noble gases which are highly ionized by an electric charge. The jet can be adjusted to many positions and produces a variable, visible flame from 1 to 6 in. long.

Plasmatron unit is contained in a handsome cabinet housing the gas supply, power unit, necessary water and gas flow meters, temperature gages, power and gas control knobs and recording meters.—**Plasmatron, 18400 South Main St., Santa Ana, Calif.** 192B

Heat Exchanger

Handles large heat capacity with high air flow.

Air moved over an arrangement of heavily finned tubes by two propeller fans provides high heat removal with the newly designed Aero heat exchanger. It is particularly adapted for cooling fluids or for condensing vapors in chemical process applications.

Units are built in a range of four standard sizes up to maximum dimensions of 63 in. high and 126 in. long. Multiple units can be stacked vertically or horizontally. Standard construction is hot galvanized steel surface and casings; other corrosion resistant materials are available.—**Niagara Blower Co., 405 Lexington Ave., New York, N. Y.** 192C

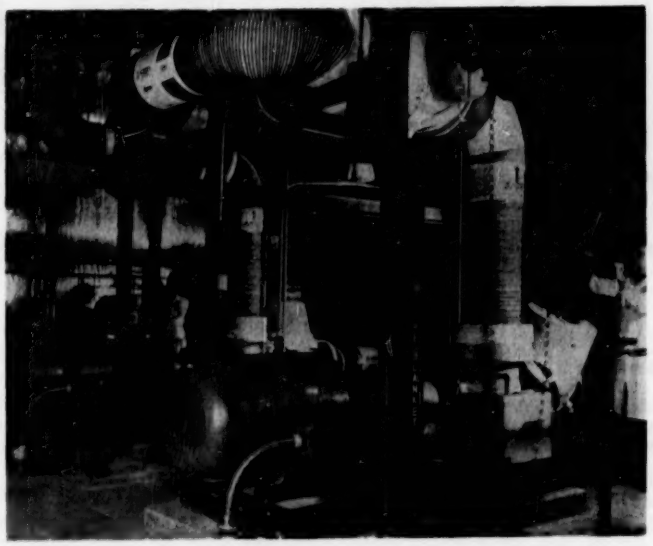
Tubular Heater

Now available as low-cost, standardized unit.

Econotherm heater design now has been standardized to satisfy requirements for a low-cost, tubular heater for non-critical continuous processing in the petroleum and chemical industries. It supplements the gradiation heater used for critical processing.

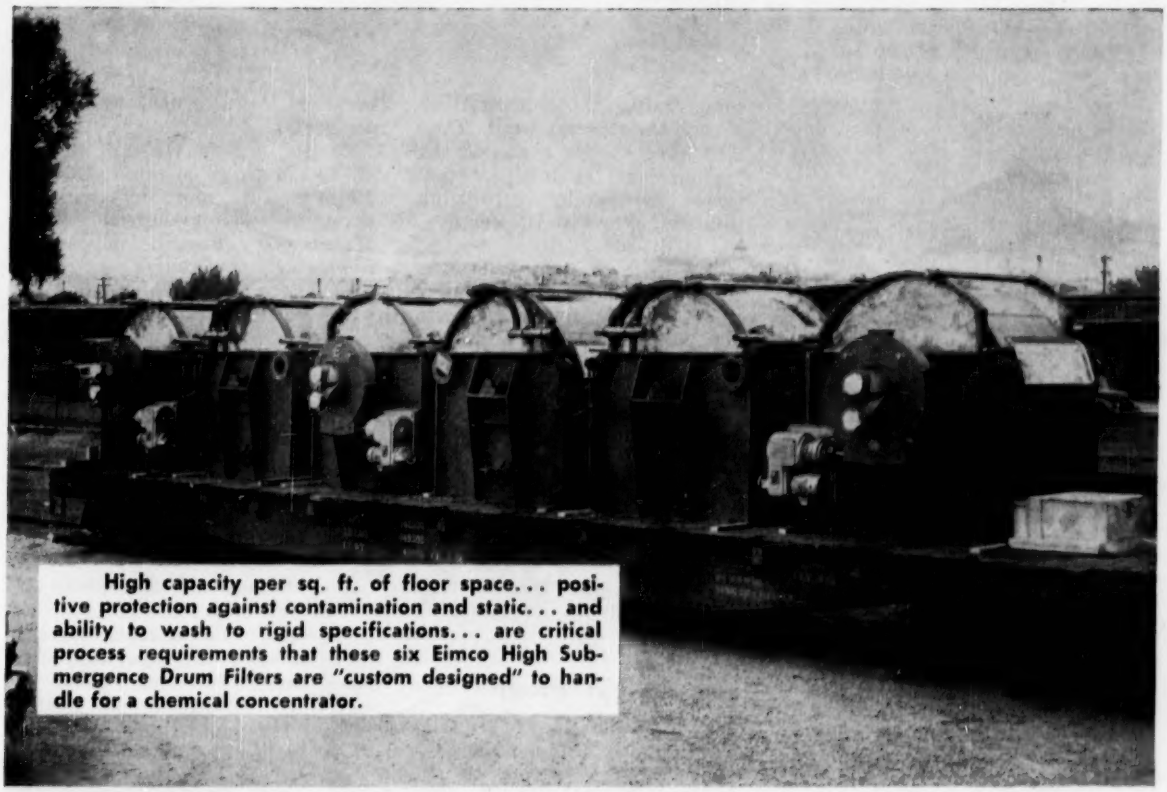
Availability of this heater meets the increasing number of applications where heating is accomplished below decomposition temperatures and where low first cost is important.

Three configurations of the Econotherm heater are available: 8-17 million Btu./hr., 17-30 Btu./hr. and over 30 million Btu./hr.—**Selas Corp. of America, Dresher, Pa.** 192D



Organic Coolant Transfers Heat From Reactor

Scientists check coolant valves on Organic Moderated Reactor Experiment to be conducted at the AEC's National Reactor Testing Station, Idaho Falls, Idaho. Experiment aims to prove the feasibility of a power reactor moderated and cooled by a hydrocarbon. Cooling system will dissipate 16,000 kw. of heat by circulating 7,200 gpm. of organic coolant from the reactor core to an air-blast heat exchanger. — Atomics International, P. O. Box 309, Canoga Pk., Calif. 192E



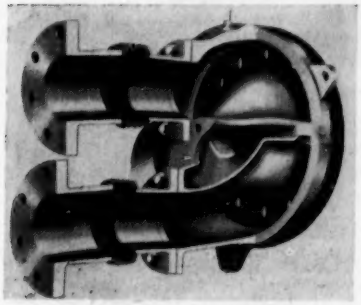
High capacity per sq. ft. of floor space... positive protection against contamination and static... and ability to wash to rigid specifications... are critical process requirements that these six Eimco High Submergence Drum Filters are "custom designed" to handle for a chemical concentrator.

600 GALLONS PER MINUTE

EIMCO GETS ALL THIS FILTERING CAPACITY ON 400 SQ. FT.

To fit most profitably into his nitro cellulose fibre flowsheet, our customer needed small filters with ability to process the slurry at an extremely high filtration rate.

Our solution was to "custom build" around **Eimco Hy-Flow Design.**



EIMCO HY-FLOW VALVE DESIGN

The result? Six Eimco 6' diameter x 3' 6" face High Submergence Drum Filters with enlarged, streamlined piping to conduct filtrate and air thru the filter and valve at minimum turbulence. This permits each filter to handle a 100 GPM flow on 67 sq. ft. — a filtering rate of 1.5 gallons per minute per sq. ft.

Specifications also imposed rigid purity and static-elimination demands upon the equipment. This required precision engineering, utilizing various, carefully-selected materials (bronze, stainless steel, brass, etc.) in different phases of filter construction.

To get thorough wash results, critical in the production of nitro cellulose, these Eimco Filters are designed to efficiently handle large volumes of wash water.

Regardless of the size or type of your installation... whatever your process may be... there's an Eimco Filter to fit your job. Eimco Filters are available in a complete range of sizes and capacities and are custom designed to your application by engineers who have thorough experience in filtration and agitation. For full information, write The Eimco Corporation, Salt Lake City, Utah, or request a visit from an Eimco Engineer.

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B 278



Self-Aligning Coupling

Used with light-wall pipe or tubing.

Within 15 min. or less, you can install the Swepco SS coupling to connect plain-end stainless-steel pipe and tubing. No preparation of pipe ends is required. All you need is an open-end or ratchet wrench.

A tapered gasket design and internal lip gives smooth sealing action and provides an even interior surface. Gasket compresses within itself and moves uniformly around pipe, affording an allowance for mis-alignment of pipe ends. Flow is continuous with minimum buildup within the lines.

Couplings are designed for working pressures of 100 psi. and for pipe sizes up to 12 in. Gaskets are furnished in various compositions of synthetic and natural rubber.—**Swepco Fittings, Inc., 6 Clifton Blvd., Clifton, N. J.** 194A

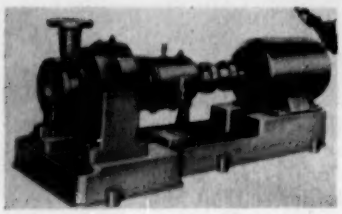
Expansion Joints

Now have longer life, greater stability.

Four major improvements are reported for an improved line of corrugated self-equalizing expansion joints for power and process piping systems. These improvements are 100% longer life, 30% reduction in length, 30% less weight and greater stability at high pressures due to reduction in ratio of length to diameter.

Equalizing rings on these expansion joints distribute pipeline expansion equally to all of the corrugations to prevent compressing the corrugations beyond their design limit. They also support the roots of the corrugations against internal pressure, thereby permitting thinner bellows and lower flexing stresses.

Available in sizes from 3 to 72-in. dia., these stainless-steel joints are used for pressures to 300 psig. and temperatures to 1,600 F.—**Zallea Bros., 815 Locust St., Wilmington 99, Del.** 194B



Centrifugal Pump

Standardized, vertically-split for heavy service.

Designed for heavy duty service in the chemical, petroleum and allied industries, a new line of centrifugal pumps uses standardized parts to permit substantial reductions in field parts inventory.

Any HN (end suction, top discharge) or HNT (top suction, top discharge) pump on the same bearing assembly uses identical bearings, shaft, sleeve, throat bushing, seal gage and gland, and other small parts. All HNC (integral seal) pumps use the same size seal.

These pumps are constructed with centerline-supported casings and circular casing joints with confined gaskets. Casings are sufficiently thick to withstand working pressures up to 600 psig. Working temperature range extends to 850 F. Shafts and bearings are sized for minimum deflection.—**Worthington Corp., Harrison, N. J.** 194C

Air Compressor

New, heavy duty, semi-radial type.

A new heavy duty industrial air compressor in the 350 to 1,000 hp. range is reported to be the largest package-type compressor available.

Output of the WN-224 unit at 80-125 psig. is rated from 2,418 to 6,048 cfm., depending upon the motor horsepower. Machine is four-cylinder, double-acting semi-radial, water-cooled type which achieves final pressure in two stages.

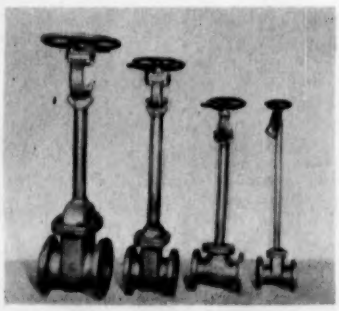
Three standard single models and three Twin-Unit models are available. Drive may be electric motor, diesel engine, steam turbine or turbo-electric combinations.—**Joy Mfg. Co., Oliver Bldg., Pittsburgh Pa.** 194D

Spray Nozzles

Wide angle, high capacity, full cone type.

Several new nozzles have been added to the spray line of wide-angle, full-cone, center-jet spray nozzles for chemical processing applications.

Working in the high-capacity range, these nozzles have a spray angle of 120 to 140 deg. Easily removable, streamlined multivane centers assure uniform distribution and maximum atomization. Standard nozzles are made of brass, cast iron, steel and stainless steel. Special nozzles can be made to order from any machinable material.—**Spray Engineering Co., 114 Central St., Somerville 45, Mass.** 194E

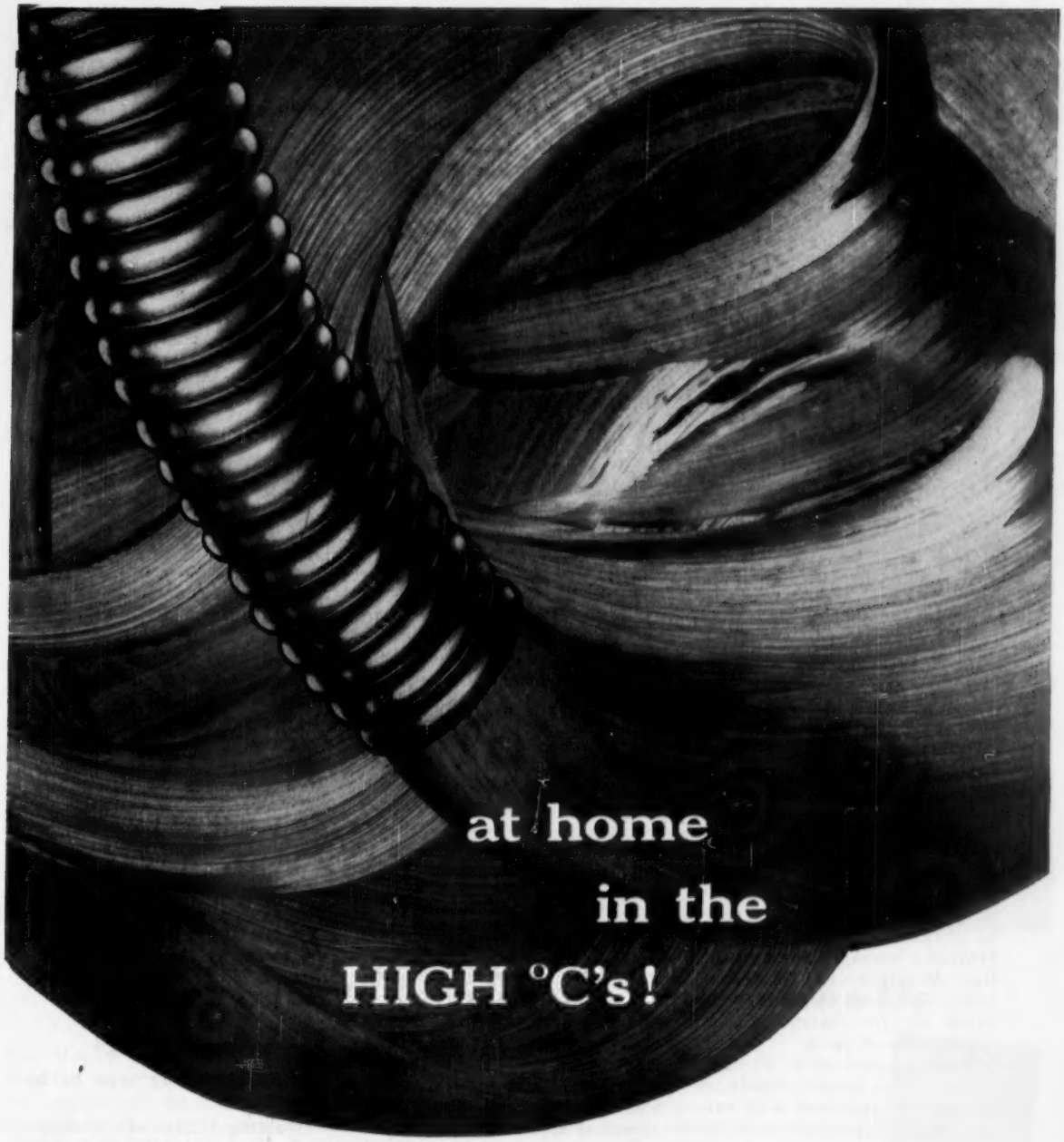


Cold Valves

Designed for service on liquid oxygen.

A new line of stainless-steel gate and globe valves has been introduced for service on liquid oxygen and other extremely low temperature liquids.

Extended bonnets on these



PUT ATLANTIC FLEXIBLE STAINLESS STEEL HOSE TO WORK in any inferno of high temperature and high pressure corrosive gases and liquids. It Stands Up! . . . Every inch . . . JOB TESTED & CERTIFIED . . . for unequalled leakproof qualities, durability, strength and lightness. Use it to control movement and vibration . . . correct misalignments . . . to compensate for expansion and contraction . . . in process lines . . . for loading and unloading.

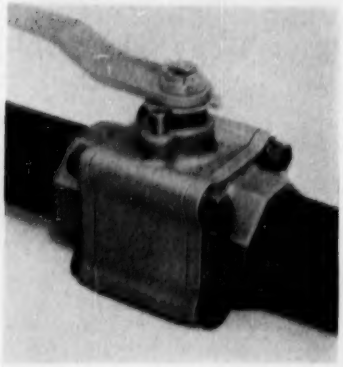
Available in sizes ¼"-4" I.D. inclusive with appropriate fittings. Produced in various alloys of stainless steel —— in monel, bronze, and carbon steel. Write for Bulletin 21-A. See our Catalog in Sweet's File for Product Designers.

ATLANTIC METAL HOSE CO., INC.

329 Dyckman Street, New York 34, N.Y.

valves permit use of heavy insulation between the operating mechanism and the pipe line. This prevents heat pickup into the valve and its contents, allowing free movement of the operating mechanism.

Valves operate at around −300 F. and pressures of 150-600 psi. Furnished with Teflon packing, they range in size from ¼ to 12 in.—**Cooper Alloy Foundry Corp., Hillside, N. J. 194F**



Ball Valve

Designed with built-in union to ease coupling.

Functions of a union and a ball valve have been combined in the new Union-Ball valve. With this valve there is no need to install a separate union to provide a breaking point in the line. Merely by removing four bolts, the center section may be lifted out for maintenance or replacement of parts.

Metal components of this valve may be bronze, aluminum bronze, or aluminum with carbon steel, Types 303 and 316 stainless steel. Seat and seal materials may be Buna-N, Hypalon, neoprene, natural rubber or Teflon.—**Worcester Valve Co., Inc., 20 Parker St., Worcester, Mass. 196A**

Air Lift Pump

Efficient design for low lift applications.

For lifts of 4 ft. or less, a new air lift pump is more efficient with less operating, maintenance and installation cost than centrifugal pumps. It is particularly suited for pumping encountered in industrial water and waste treatment plants.

Air lift pumping is analogous to a chimney. Finely diffused air introduced at the bottom of a hydraulic draft tube decreases the density of the water column in the tube. Resultant unequal pressure at the bottom of the tube causes the unaerated water to push into the bottom of the tube thereby producing an upflow of liquid.

The new Airopump uses a central radial-type expanded diffuser to introduce air into the updraft tube. Height of the diffuser is adjustable.

Spiral vanes above the diffuser eliminate coalescence and continue the homogenization of the air-water mixture. Combined design features of the diffuser and vanes assure maximum utilization of the air in pump.

A head recovery zone in the top third of the updraft tube reduces velocity head losses, increases efficiency and extends the useful capacity range of the air lift. Combined with the discharge stack at the outlet, this recovery zone is a large factor in the high efficiency of this pump. — **Walker Process Equipment Co., 840 North Russell Ave., Aurora, Ill. 196B**

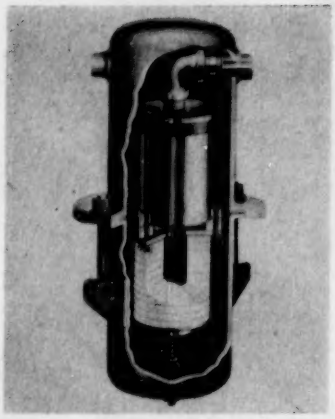
Centrifugal Pump

Closed coupled, end suction, general purpose.

A new series of Type B general purpose centrifugal pumps is designed to circulate liquids in air conditioning, refrigeration, coolant, hot water and chemical applications.

Pumps possess low NPSH characteristics to meet critical suction conditions. Advanced design impellers are exactly balanced to provide peak performance characteristics smoothly and quietly.

Series includes horizontal, close-coupled horizontal, pedestal-mounted, flange-mounted vertical and base-mounted vertical units. Sizes range from ½ to 7½ hp. with choice of mechanical seals or packing glands. — **Aurora Pump Div., New York Air Brake Co., 43 Loucks St., Aurora, Ill. 196C**



Gas Filter

Removes small amounts of contaminants from gas.

Small quantities of true vapor and liquids may be removed from compressed gases by the Du Phase filter. It will also remove small amounts of contaminating vapors from gases which might injure products.

Action of the filter combines absorption and adsorption. Compressed air or gas being filtered travels first through a conventional set of absorption pads. Then, it rises through a metal canister or cartridge containing an adsorbent such as activated carbon or silica gel.

Canister or cartridge life is approximately 150 hr.—**Dollinger Corp., 11 Center Pk., Rochester 3, N. Y. 196D**

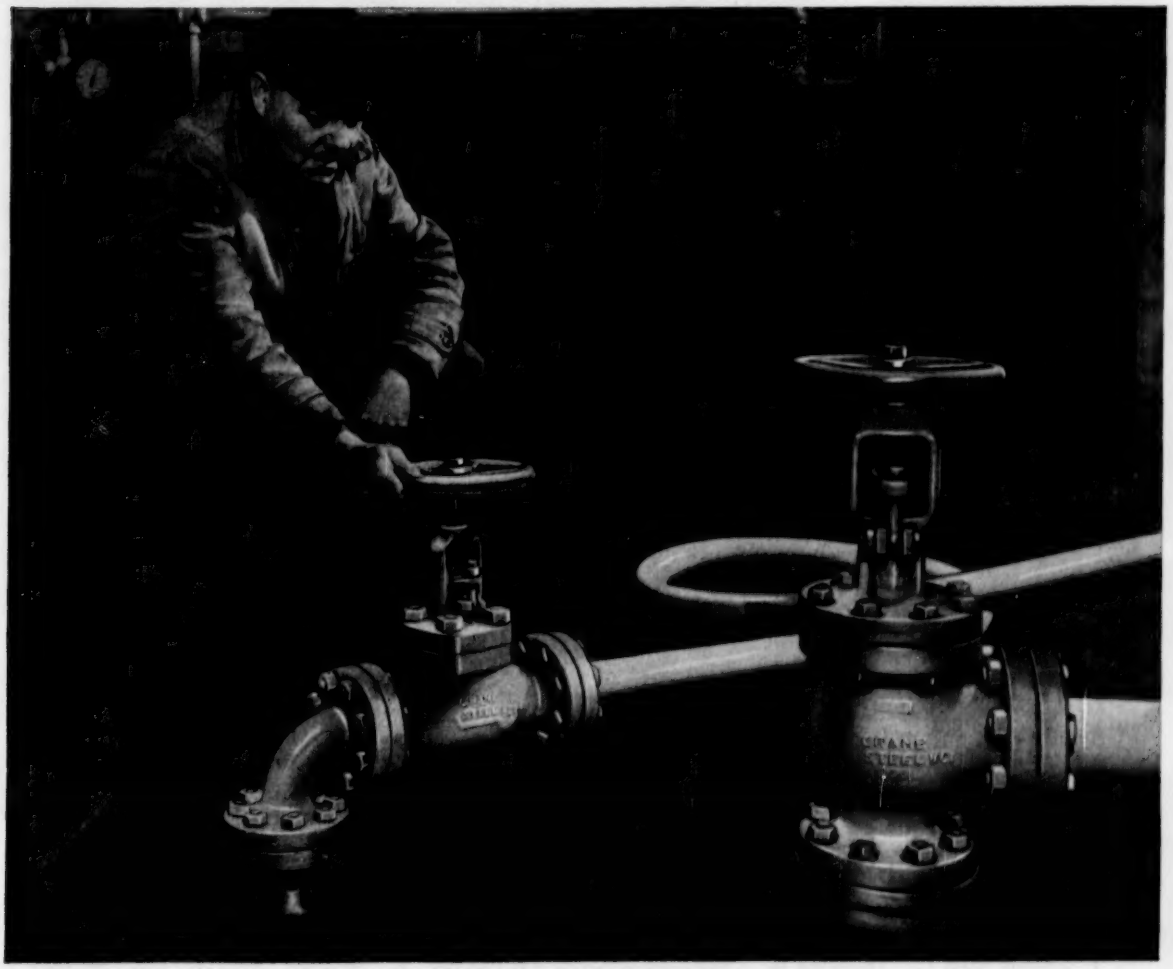
Zirconium Fittings

First welding type to be forged.

Welding fittings of zirconium and zircaloy 2 are believed to be the first to have been forged from these metals. Having an outside diameter of 1.5 in. and a 0.065 in. wall thickness, they were designed for a nuclear energy application.

When properly applied, zirconium and Zircaloy 2 have properties that permit important economies. It is reported that designers in the chemical and nuclear fields are specifying them increasingly where severe corrosion conditions are met. — **Tube Turns, 224 East Broadway, Louisville, Ky. 196E**

Hooker cuts valve maintenance costs on chlorine service



Crane chlorine valves have longer service life

The Hooker Electrochemical Co. knows that the hazards of liquid chlorine loading rack service call for valves that can stand the gaff. That's why it selected Crane No. 1654 and No. 1655 flanged end globe and angle valves for its Tacoma, Wash., plant.

Except for infrequent servicing of the packing, these Crane valves have been entirely free of leakage and maintenance since being installed over three years ago.

What gives Crane chlorine valves this extra performance value?

Each part is designed of materials suitable for the service needs. Carbon steel body has heavy wall sections for safety. Monel stem and Hastelloy "C" seating combination withstand the corrosive effects of chlorine. Narrow bearing 45° taper disc and seat design breaks down hard deposits on seating surfaces, assures positive closure. Teflon stem packing assures tight stuffing box, with easy operation.

If you are handling water-free chlorine gas or liquid in your plant, it will pay you to ask your Crane Representative about the complete line of Crane chlorine valves.

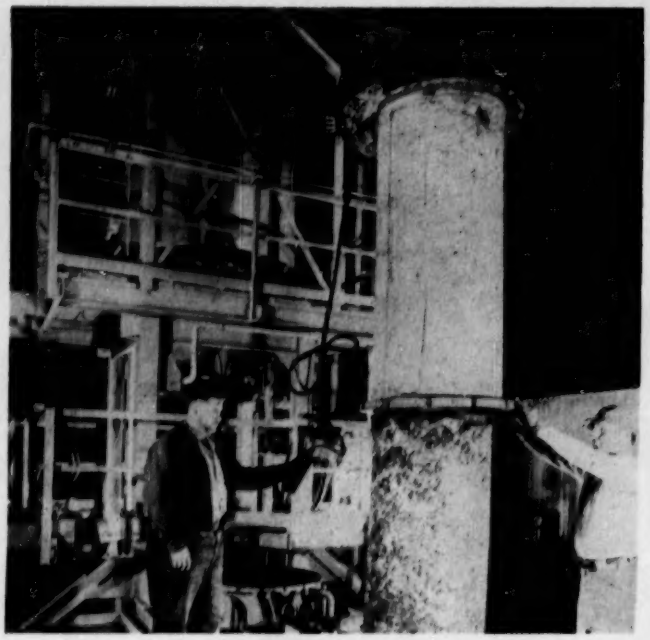


ASK YOUR CRANE MAN for a copy of "Valve Performance Facts"—32 case histories throughout industry. Or write to Crane Co., address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas



Titanium Furnace Now Offered Industrywide

Workmen strip titanium ingot from mold of consumable electrode vacuum remelting furnace which was developed over a 10-yr. period by Titanium Metals Corp. of America and Allegheny Ludlum Steel Co. According to a recent announcement, similar furnaces will be available to the metals industry for the first time. With it, all the refractory metals and many precision superalloys can be production melted into large homogenous ingots at great speed and relatively low cost. Even many of the common metals may find this melting technique advantageous. —Lectromelt Furnace Div., McGraw-Edison, Elgin, Ill. 198A

Pressure Vessels

High-pressure spheres of titanium alloy.

Fabricated from titanium alloy or other materials, high-pressure spheres from 12 to 25 in. dia. are now being offered to industry.

Vessels are formed by first spinning hot hemispheres, then welding these together with the other segments to form the finished vessel. This combination of techniques is relatively inexpensive compared to previous methods of forming vessels. And it can be used for small or large orders, is adaptable to prototype or experimental use. — **Titanium Fabricators, Inc., 3906 Cohasset St., Burbank, Calif. 198B**

Column Redistributors

Double plate efficiency of packed columns.

Based on several years of field testing, giant packed-column redistributors boost plate efficiency 100% or more in most cases, it is reported. Using these redistributors, it is possible to realize the economy and low pressure drop of large diameter packed columns, while obtaining the separating efficiency which has been lacking previously.

Patented unit collects liquid which tends to run down the column wall and distributes it evenly across the packing. Thus, it is possible to keep the packing wet and at top efficiency at all liquid rates. Pressure drop, hold up or throughput rate are not affected.

Redistributors up to 6½ ft. have been tested with Raschig rings, Berl saddles, Intalox saddles and protruded packing.— **Distillation Engineering Co., 105 Dorsa Ave., Livingston, N. J. 198C**

Vibratory Feeders

High output and efficiency over wider range.

A new improved line of HI-VI electro-permanent magnetic vibratory feeders provides greater output than other units of comparable size. Operating efficiency is higher over broader operating ranges; materials may be moved at a faster rate.

Drive element is completely enclosed for protection against moisture, chemicals or foreign materials. Special disk-shaped springs of bonded glass fiber replace metallic leaf springs used in old-style vibratory equipment.

Units retain the same electro-permanent magnetic drive system used formerly. This system requires no rectifier. Rather a life-time powered Alnico V magnet produces an automatic, trouble-free, efficient magnetic rectification system. — **Eriez Mfg. Co., Erie 6, Pa. 198D**

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POWELL VALVES

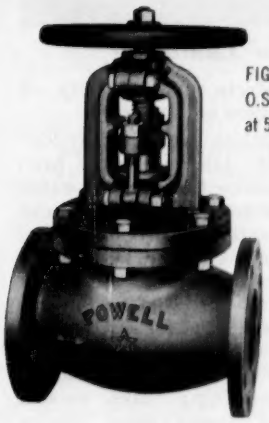


FIG. 2429—Large Size Stainless Steel O.S.&Y. Globe Valve for 150 Pounds W.P. at 500 F. or 230 W.P. at 100 F.

FIG. 1314A—1500-Pound Integral Bonnet Stainless Steel "Y" Valve.

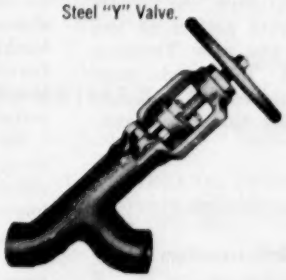


FIG. 2342—Stainless Steel Bolted Cap Swing Check Valve for 150 Pounds W.P.

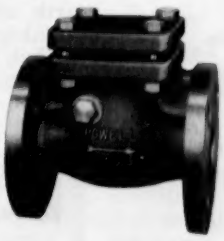


FIG. 2453SG—Stainless Steel O.S.&Y. Gate Valve for 150 Pounds W.P.



Designed for long life, designed for dependable service

Consult your Powell Valve distributor for all the facts about quality proved bronze, iron, steel and corrosion-resistant valves. For every flow problem . . . there is a Powell Valve to solve it.

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Impervious Coating

Applied to concrete, closes pores completely.

Applied directly over concrete blocks, Ceramix coating gives a durable, impervious highly glazed surface. No special preparation of the surface is needed before application; no baking or heat treatment of any kind is required.

Recently, Brookhaven National Laboratory was reported to have used the material to seal the pores of concrete walls in a building associated with processing of reactor fuel elements. Only thus could the walls be decontaminated from normal buildup of radioactive salts. Daily hosing of the walls frees the impervious surfaces of any radioactive contaminants.

Tests conducted by an independent testing laboratory are claimed to show that Ceramix wall is highly resistant to harsh and caustic chemicals.—**Preco Chemical Corp., 119 Allen Blvd., Farmingdale, L. I. 200A**

Insulating Fabrics

Withstand temperatures up to 1,500 F.

Fabrics constructed of Fiberfrax brand ceramic fiber are now available in various widths or thicknesses for positive high-temperature insulation. In addition, they also are supplied as instrumentation tapes for both insulation and leak detection.

Tapes consist of two stranded Chromel wires covered with reinforced ceramic fiber. Wrapped around pipes as small as ¼-in. dia., it insulates and triggers an alarm by short circuiting in the event of a leak.

These fabrics can be treated with silicone rubbers, epoxy resins, or impregnated with phenolic resin and molded into various shapes. Or, they can be woven in tubular form.—**Russell Mfg. Co., 268 East Main St., Middletown, Conn. 200B**

Airborne Warehouse

Used widely for temporary storage at low cost.

A tent-like structure supported entirely by a large volume of low-pressure air from a continuously operating blower is finding use on the industrial front. Many companies find it makes excellent dry, weathertight storage that is portable and offers low maintenance cost. Complete erected structure costs slightly more than $1.00/sq. ft. of storage space.

Structure is made of a vinyl-coated nylon fabric that is sufficiently translucent to permit usual storage activities inside. A 4 x 8 ft. door permits easy passage with a fork lift truck. Electric power consumption to operate the blower is reported very low.—**CID Air Structure Co., 1501 East 96th St., Chicago 28, Ill. 200C**

Pipe Conduit

Prevents corrosion of underground heating lines.

Neither moisture nor corrosive electrolytic action of the earth affect the new Temploc prefabricated insulated pipe conduit. Initial cost is reported about 20% less than steel conduit and it weighs only one half as much.

Temploc is constructed of pipe and fibrous-glass insulation protected by a strong jacket of spirally wrapped glass cloth and Laminac brand polyester resin. The protective shell is built up of two plies of cloth and resin over a sheath of kraft paper. By itself, the shell is strong enough to resist bursting in a low pressure system.

Temploc comes in sizes custom-cut to specific architectural and engineering specifications. System is delivered to the site complete with units numbered and ready to install according to blueprints for the job.—**Temploc, Inc., Baldwin Pk., Calif. 200D**



Plastic Laminate

Protects wide variety of process equipment.

Production facilities for Kel-F plastic laminate have been increased to help supply catch up with demand. Laminate can be cemented to any surface of almost any contour. Glass cloth backing for the plastic layer furnishes a surface which bonds readily to substrates of metal, wood, rubber or plastic.

Kel-F plastic laminate is ideal for lining tanks, vessels, reactors, drums, pipes, chutes, hoppers, fume hoods and ducts. It has zero moisture absorption, high tensile strength and impact resistance, low cold flow, low-temperature flexibility, is non-flammable and non-toxic. It is impervious to all chemicals, all alkalies and most solvents, is suitable for use at temperatures ranging from −100 to 350 F.—**United States Gasket Co., Camden 1, N. J. 200E**

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INTERNATIONAL
MAGNESIUM OXIDE 99.0+%

In the highest purity ever produced in carload quantities and in the low price range



International MgO has demonstrated its versatility and superiority in these and many other applications—

- **AS A STABILIZING AND VULCANIZING AGENT FOR RUBBER**
- **IN HIGH TEMPERATURE HEATING ELEMENTS**
- **AS A PRECIPITANT OF YELLOW CAKE IN URANIUM ORE TREATMENT MILLS**
- **IN PRODUCTION OF HIGH-MELTING-POINT REFRACTORY BRICKS**

International's research staff is prepared to give you technical assistance in the study of end use problems. Please use the coupon in requesting samples and more information.

chemical specifications

chemical		purity range
MAGNESIUM OXIDE	MgO	99.00 – 99.80%
IRON	Fe_2O_3	0.04 – 0.06
LIME	CaO	0.07 – 0.08
SILICA	SiO_2	0.05 – 0.10
ALUMINA	Al_2O_3	0.04 – 0.09
BORON	B_2O_3	0.003 – 0.01
CHLORIDE	Cl	0.02 – 0.04
SULFATE	SO_4	0.03 – 0.05
SODIUM AND POTASSIUM	Na+K	0.02 – 0.04
LOSS ON IGNITION		0.20 – 0.30

physical specifications

(Color . . . White)

PELLETS

Approx. ⅛" x ⅛", plus 12 mesh
Bulk density: 60 lb. cu. ft.

GRANULAR

All minus 12 mesh
Bulk density: 70 lb. cu. ft.

POWDERED

100% minus 200 mesh
90%+ minus 325 mesh
Bulk density: 80 lb. cu. ft.

shipments

Bulk in box cars and covered hopper bottom cars, minimum 30 tons net.

80 lb. net multi-ply paper bags with moisture resistant barriers and 100 lb. net fiber drums for carload, truckload and L.C.L. deliveries.

All shipments F.O.B. Carlsbad, New Mexico.

Direct truck service to all points in the Colorado plateau on 24 hours' notice.

price range

International MgO prices range from $110 to $250 per ton, F.O.B. Carlsbad, depending on grade, packaging and quantity.

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Caustic Potash	Sulfate of Potash
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☐ Please send me samples of MgO in _____ form
(pellet – granular – powdered)

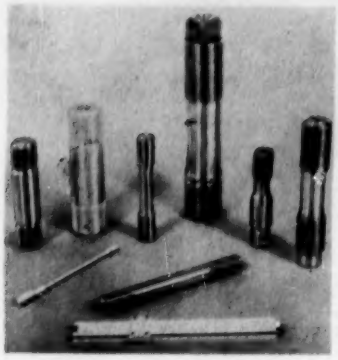
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My field of interest for MgO is _____

Name _____

Firm _____

Address _____

City _____ State _____



High-Strength Studs

Satisfy need for critical fastening of equipment.

Special high-strength studs are now available to satisfy the growing need for reliable large-diameter bolting for critical fastening. This need has been intensified by rapidly increasing pressures, temperatures and speeds of modern-day process equipment.

Custom engineered studs are made from a variety of high-strength, high-temperature and corrosion-resistant alloy steels. For moderate temperature applications, studs can be supplied that have tensile strengths of 220,000 psi. or more. At 900 F., they can be supplied with tensiles as high as 170,000 psi.

Studs range in size from ½- to 6-in. dia. and from 6 to 72 in. long. Some weigh as much as 800 lb.—**Standard Pressed Steel Co., Jenkintown, Pa. 202A**

Silicon Rectifiers

For use with electrostatic precipitators.

Users of electrostatic precipitators now may realize the many electrical and physical advantages of silicon rectifiers with a recently announced oil-immersed unit. By conservative estimate, this new unit will extend life of the precipitator rectifier to at least 10 yr.

Field tests on these new rectifiers show efficiencies of 96% which is 11-16% better than usually obtained with tube sets. Compared with selenium, they are substantially smaller, have high conductance and power handling ability and allow greater circuit efficiency and higher temperature stability.

Silicon rectifiers to be available first are designed for new precipitator installations. Modified designs to replace mechanical rectifiers are being prepared for combination with transformers now operating.—**Research-Cottrell, Inc., Bound Brook, N. J. 202B**

Flange Gages

Check identity and accuracy of flange ring grooves.

For users of ring-type joint flanges, a complete line of gage sets is now available. These determine the identity and accuracy of ring grooves which have been standardized over the wide range of pipe-line sizes and pressure ratings.

Gages are machined accurately to identify the pitch diameters with the proper width and depth of grooves in all of the standard dimensional characteristics. Gages can be obtained in sets that contain the sizes used most frequently. Expanded groups can be supplied for odd sizes and higher pressure ratings, or they can be supplied to apply to the full range of ring numbers.—**Engineering Corp. of America, 24 Prospect St., Westfield, N. J. 202C**

Stationary Batteries

Use plastic jars to increase rated capacity.

Largest plastic battery jar ever molded has enabled Exide to complete conversion of its stationary batteries from glass to plastic jars. Use of the polystyrene jar increases rated capacity, assures a permanently leakproof jar and substantially increases electrolyte volume.

Giant container is 19⅛ in. deep by 14½ by 13⅝ in. and is used for the largest cells in Exide's line—the FMP-25 Exide-Manchex and the FOP-31 Exide Tytex. Use of the plastic jars permitted boosting the plate size to gain up to 11% in rated capacity. — **Exide Industrial Div., Electric Storage Battery Co., Box 8109, Philadelphia 1, Pa. 202D**



Ground Detector

Tests circuits while they are hot.

New high voltage Allen ground detector tests ungrounded and modified grounded circuits from 0-2,300 v. while circuits are "hot" and equipment is operating. With it, your maintenance men may find ground faults quickly during regular hours. That way, faults can be cleared from the line before costly equipment damage, production loss or fire can result through a second fault ground on the line.

Detector consists of a portable generator and a hand-held signal receiver. Generator impresses a pulsating signal of line voltage on the grounded phase conductor. This signal is followed visually with the receiver to the ground fault where the meter ceases to pulsate. — **Excel Electric Service Co., 2113 South Western Ave., Chicago 8, Ill. 202E**

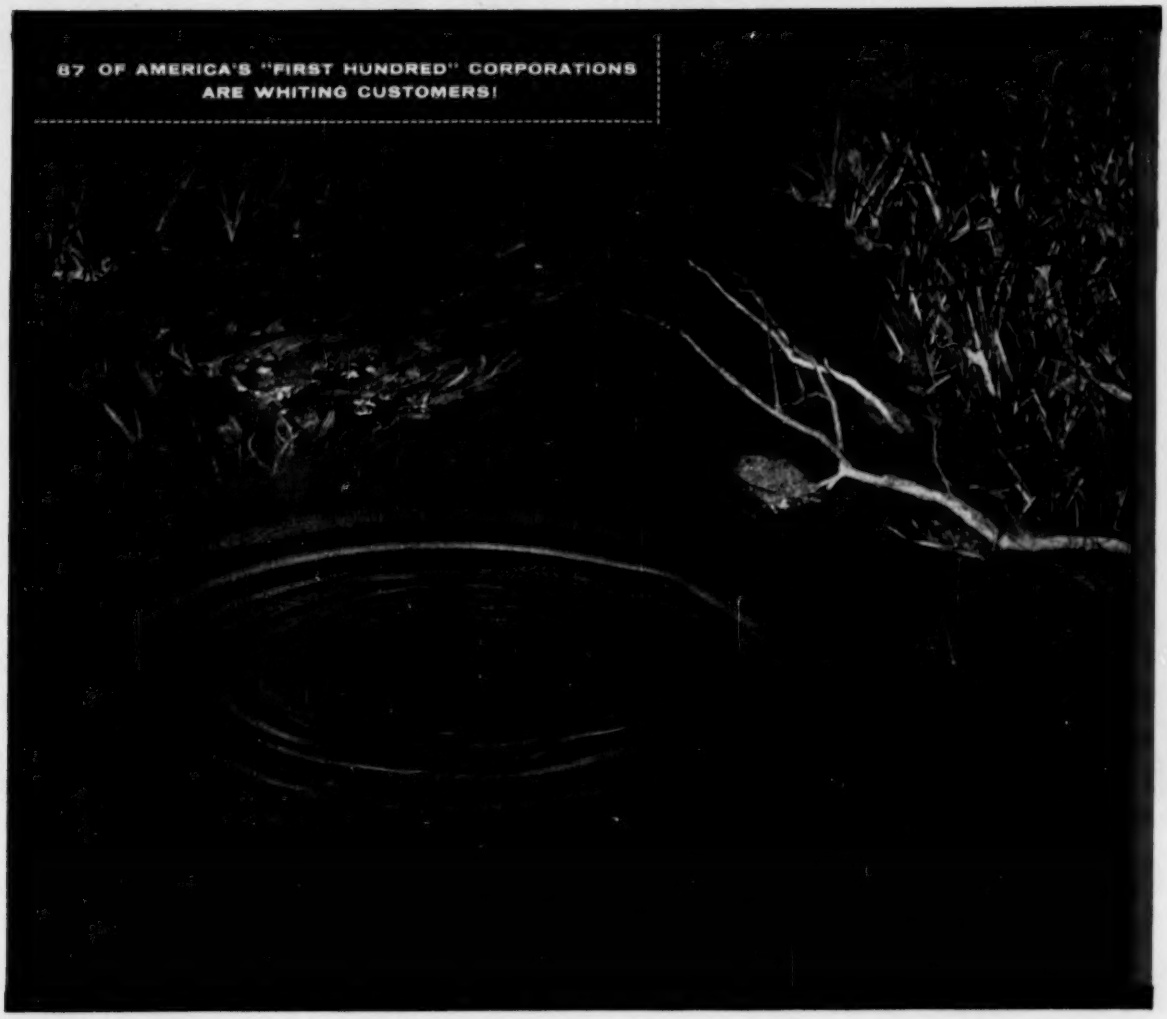
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SLOGANS speak of happy combinations as . . .

Blends Spur Fiber Sales

New textile mixtures offer bigger markets for non-cellulosics, a shot in the arm for natural fibers, but little solace for a worried rayon industry.

Mary Gibbons, Assistant Editor

Fiber blends are making textile news these days. So much so that they now figure decisively in the fortunes of nearly every fiber, natural or synthetic.

Substance of the big sales push is the suggestion that for best results you need the comfortable wearing qualities of conventional fibers coupled with, say, a polyamide's light-weight strength or a polyester's easy care.*

▶ **Blends Blossom** — Public acceptance of—and satisfaction with—this premise is showing up in market demands for synthetic fibers.

• Du Pont claims Dacron-worsted suits accounted for nearly 35% of this summer's six-million-suit market. (This compares with the 1953 figure of 7%.)

• Millions of yards of Dacron-cotton fabric have already been sold.

• Last year Orlon-wool jersey (80% Orlon-20% wool) accounted for 50% of all jersey on the market.

• This Fall knitted pile fabrics of Dynel-Orlon are expected to give the cheaper furs and expensive coat fabrics a run —625 thousand coats—for their market. (This figure represents a 25% increase over last year's sales which tallied $50 million on the retail market.) Right now, too, cutters and manufacturers are reporting a bottleneck in these knitted fabrics. They say there just isn't enough equipment to make the coats they claim are preferred three to one over the woven products.

• The Bureau of Census reports that, in 1956, some 600,000 yds. of fabrics contained new fibers, either alone or in blends.

Consumer satisfaction is showing up in the over-all market picture, too. It helps explain why although production in the synthetic fiber industry as a whole dropped 6% last year, from 1.7 to 1.6 billion lb.—despite a forecasted 10% increase — noncellulosics (primarily polyamides, acrylics, polyesters) showed a healthy 70-million-lb. increase for the same period, hitting 400 million lb. for 1956.*

Peak for these key blend fibers this year will probably scale upwards of 450 million lb. First-quarter figures already rate them at 145 million lb.—about 12 million lb. better than the previous quarter.

▶ **Effects on Capacity**—Du Pont reports that its Dacron operations are blasting at full capacity (50 million lb.). U. S. polyamide production, too, is nearly synonymous with the capacity figure of 350 million lb. And, acrylics—which are also making headlines—boast a 120 million lb. potential. These fibers account for the biggest chunk of the admitted capacity total (520 out of 560 million lb.).

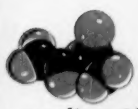
There are big plans for future expansion too. By late 1958, total non-cellulosics capacity will hit close to 800 million lb. Leading the pack will be acrylics and

*Blend promotion is attuned to the mood of our times. A gradual swing in living habits in the past few years has had an extreme effect on the type of clothing the consumer buys. Now with more money and more leisure time, Americans have two wardrobes: one for dress-up occasions, one for casual wear. But for either wardrobe, they demand clothes which look well, wear well, give light-weight comfort.

*Brunt of the loss was shouldered primarily by the cellulosics: Rayon yarn output was off 13% while acetate yarn dipped 16%. These losses put total rayon and acetate production 113 million lb. below the 1955 level.



VINYL MONOMERS . . . endless possibilities, thanks to polymer chemistry



Vinyl acetate . . . vinyl propionate . . . methyl isopropenyl ketone . . . and now acrylic acid esters . . . these Celanese monomers are starting points for practically endless product improvements. They have already enabled production of better binders for non-woven fabrics and for water and grease-resistant coatings. They have improved plastics . . . they have improved the properties of emulsions for latex paints, leather, paper and textiles . . . they have enhanced properties of synthetic fibers and rubbers.

These are but a few of the improvements engendered by the Celanese series of monomers. And Celanese research, development and production know-how promise more and better basic materials for polymer chemistry. The new acrylic acid esters, for example. The unit for their production is nearing completion and soon will be "on stream," supplying acrylates in commercial volume.

Constant research for more productive basic organic chemicals...availability of a vast supply of raw materials to keep production in continuous volume...these are the factors upon which Celanese bases its service to industry. Celanese Corporation of America, Chemical Division, Dept. 553-S, 180 Madison Avenue, New York 16, N. Y. Celanese®

Basic reasons . . . . . for improved products

Acids	Functional Fluids	Polyols
Alcohols	Gasoline Additives	Plasticizers
Aldehydes	Glycols	Salts
Anhydrides	Ketones	Solvents
Esters	Oxides	Vinyl Monomers

Celanese CHEMICALS

Agricultural	Paper
Automotive	Pharmaceutical
Aviation	Plastics
Building	Surface Coatings
Electrical	Textiles

Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., N. Y. 16.

polyamides with respective goals of 210 and 446 million lb.

The polyester, Dacron, is expected to be well in on the running, too. How well makes for interesting speculation. Du Pont admits only to a 25% increase in capacity next year. But, it's hard to believe that Wilmington is going to ignore the gleam in the consumer's eye and plan on turning out a mere 60 million lb. It's odds-on that the figure will be much higher.

What's more, there are rumors that other fiber makers are knocking themselves out to develop a polyester of their own. If they succeed, who knows what polyester capacity will be.

▶ **Effects on Consumer**—Blends have done as much, or more, in terms of public relations to put across new or fairly new fibers than the fierce advertising campaigns which launched them. Because good blends bring out the best qualities of all fibers combined, they've gone a long way toward reclaiming whatever public favor and faith was lost a few years back when "miracle fibers" were first introduced.

▶ **Cellulosics Slump** — Meanwhile, what's been happening to the old synthetic standbys, rayon and acetate?

Rayon, for one, will probably go right on appearing in so-called cheaper cottons for the sake of consumers who think of thrift only in terms of how much money they're spending at a particular time. It's difficult to detect the presence of rayon if it's kept below the critical level of about 10%. So, these fabrics can be quietly labeled "cottons" with impunity.

Both fibers will continue to be included in some blends too, just as they have in the past. But chances are they won't be any more popular than they are now and they may decline even more.

This is because consumers now have more money to spend and can afford to buy clothes which they consider to be of better quality—if they want to do so. Most of them do. That's why they stay clear of rayons and acetates which often have the inferior qualities of shrinkage and color loss.

This leaves rayon and acetate with only a fraction of the old stronghold uncontested. That is, rayon and acetate can still command much of the shopper's attention when she's out looking for some bit of finery. Dye-hungry cellulosics seem to have fewer inhibitions eating up colors than other synthetics. The brilliant shades plus the luxurious touch of the final fabric make them appealing for those special-occasion dresses.

Only trouble is that they often lose their lovely hues as readily as they acquired them—and lose them unevenly.

What's more, even where they prove satisfactory, such occasional wear isn't going to bring home the bacon to the manufacturer the way an everyday fabric will.

▶ **More Troubles Ahead**—There are other problems, too. Not only are noncellulosics encroaching on rayon's clothing grazing land, but straying onto rayon tire cord territory too. Last year, nylon took a 16% bite out of rayon's market in that field and many observers claim that this cut is actually greater because it takes less nylon to do the job.

As if this weren't enough, fear of foreign imports continues to cloud the cellulosics horizon. Though Japanese imports have been curtailed, unlimited shipments from Hong Kong and India may be on the increase.

Though cellulosics still claim the biggest place in the sun, further cutbacks will soon make the position of rayon producers not only grim but critical.

▶ **What to Do**—Something's got to be done but just what is anybody's guess.

When colorfast techniques succeed to a more acceptable extent, rayon and acetate may have a fighting chance of holding their lion's share of the market. But to get back into the fight, drastic advertising measures may be the order of the day. One rayon expert suggested, half-seriously, that a name change for rayon might pave the best way to a fresh start.

But other measures are already under way.

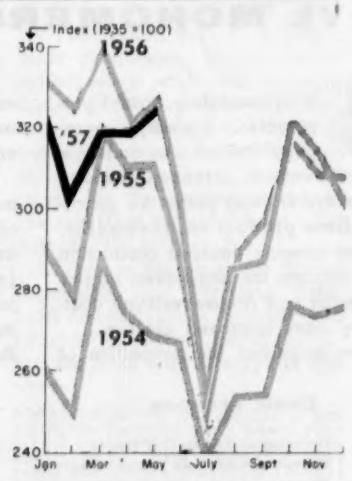
For a start, cellulosics producers who also turn out noncellulosics are expanding the latter facilities. American Enka, for instance, reports a 41% increase in shipments of nylon last year and expects a 75% boost by the end of '58.

Acetate producers, meanwhile, are looking for possible relief in an expanding market for acetate tow in cigarette filters.

At the present writing, though, authoritative sources on cellulosics are posting warnings for a stormy market future. And, until somebody or something provides a solution, company reports are probably going to go right on sounding mighty grim.

CE Index of Chemical Consumption

By Industries	April (Final)	May (Est.)
Coal products	11.6	12.3
Explosives	11.4	11.7
Fertilizer	75.1	70.6
Glass	26.0	27.5
Iron & steel	18.0	18.0
Leather	4.2	4.1
Paint & varnish	34.9	37.9
Petroleum refining	30.2	32.5
Plastics	24.7	25.7
Pulp & paper	37.2	38.3
Rayon	28.3	27.7
Rubber	6.8	7.1
Textiles	9.8	10.4
Total	318	324





ACETYLENE

...bright future for an old flame!

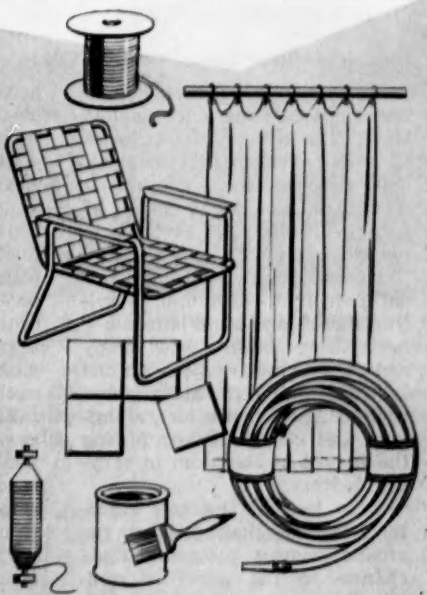
For years the use of acetylene commercially was limited primarily to the welding torch. Today, it is one of the brightest stars on the petrochemical horizon, with some 80% of total output serving as basic raw material for many of the "miracle" synthetic fibres and hundreds of other important plastic products, including *acrylic fibres, resins, solvents,* and *synthetic rubber.*

Key factor in the phenomenal growth of acetylene has been the recent development of processes for its production from natural gas. Among these new production techniques, the BASF process has had the greatest success, because of its commercially proven economy, safety and reliability.

With exclusive rights in all North American countries* for the BASF process, Chemico has designed and constructed facilities for the production of more than 150,000,000 pounds per year capacity of acetylene. This total includes the world's largest plant for producing acetylene from natural gas. This experience enables CHEMICO's highly skilled staff to handle acetylene projects with maximum efficiency and economy.

*On occasion those rights have been extended to other areas, through special arrangement with BASF.

If you are interested in the profit making opportunities offered by acetylene, we suggest you send for CHEMICO's new acetylene brochure (Bulletin No. 257), which will give you more detailed information on the BASF process and CHEMICO's experience in this field.



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Atomic Age Metals . . .

	Nuclear Uses	Non-Nuclear Potential	
		Properties	Applications
ZIRCONIUM	Cladding or diluent for fuel elements	High temperature strength; corrosion resistance	Chemical plant construction (valves, ejectors); electrolytic condensers; glass-to-metal seals
HAFNIUM	Control rods; reactor shield	High thermal conductivity; corrosion resistance; high temperature strength	Heat absorber (jet engines, missiles)
BERYLLIUM	Reflector; neutron source	High rigidity; dimensional stability; light weight; high temperature strength	Aircraft and missile structures; heat exchanger tubing; telescope mirrors; measurement and control devices for aircraft
COLUMBIUM	Cladding or diluent for fuel elements	Superior heat and corrosion resistance	Heat-resistant alloys (jet engines)

. . . Seeking New Outlets

Precocious new structural metals, thrust into importance by the urgent needs of the nuclear program, are already looking for ways to pay their own keep.

Cecil H. Chilton, Senior Associate Editor

"Metallurgical Project" is a historic code name once applied specifically to the earliest phases of atomic weapons development. Still meaningful, in a sense, it describes accurately much of today's technology devoted to nuclear energy.

Three brand new metallurgical industries—uranium, beryllium and zirconium-hafnium—have been born. And many metals which have been on the industrial scene for many years, such as lead, magnesium, aluminum and cadmium, are feeling the impact of the atom in varying degrees.

Let's look at the new structural metals—their place in the atomic energy program, their chances in the world of commerce.

Nuclear reactors are built of various metals and alloys. For some of these, like steel, stainless steel and aluminum, the nuclear market is a relatively minor one. For zirconium, hafnium, beryllium and columbium, however, the nuclear business means life itself.

▶Zirconium Has Everything—A relative newcomer to the nuclear energy picture, zirconium truly deserves the title of "young metal in a hurry." Production from two modest-size plants is due to be augmented severalfold this year when four brand new plants start operations (see table, p. 210). Big push is said to be for use in nuclear-powered ships.

Zirconium production last year was about 600,000 lb. When facilities now under construction reach capacity, output will be some 6 million lb./yr. By 1960 it may be 10 million.

Pure zirconium offers an unbeatable combination of neutron transparency, corrosion resistance and high temperature strength. It's an ideal material for structural uses in reactor cores or for cladding uranium fuel elements.

▶What Held Zr Back?—Two conditions retarded early development of zirconium: It's difficult to isolate in ductile form; for a long time zirconium's low neutron cross-section remained undiscovered.

Not until researchers prepared hafnium-free zirconium did its real potential become known. And, fortunately, by this time the technology of producing ductile titanium had been developed to the point where it could be readily adapted to zirconium manufacture.

One new zirconium producer, U. S. Industrial Chemicals, is preparing to promote the metal for commercial (non-nuclear) uses where special corrosive conditions can justify its high cost.

At room temperature zirconium resists attack by most organic acids, by sulfuric acid in most concentrations, by nitric acid in all concentrations. Its resistance to hydrochloric acid and to most chlorides is outstanding. Attack by alkaline solutions, too, is resisted successfully. Furthermore, zirconium has especially high resistance to fused alkalis.

This resistance to most acids and alkalis is a clue to potential applications. Rayon spinnerets, which must maintain precise dimensional tolerance in the face of both acid and alkaline conditions, are a good example. Zirconium spinnerets have already found substantial application in Europe.

Commercial zirconium (containing hafnium) may be soon available at prices as low as $3/lb. USI predicts that within five years a finished zirconium part will cost less than twice as much as the same part in stainless steel.

▶Hafnium Absorbs Neutrons—Hafnium byproducts, separated from zirconium ore in the process of making nuclear-grade zirconium, is a potentially valuable metal in its own right.

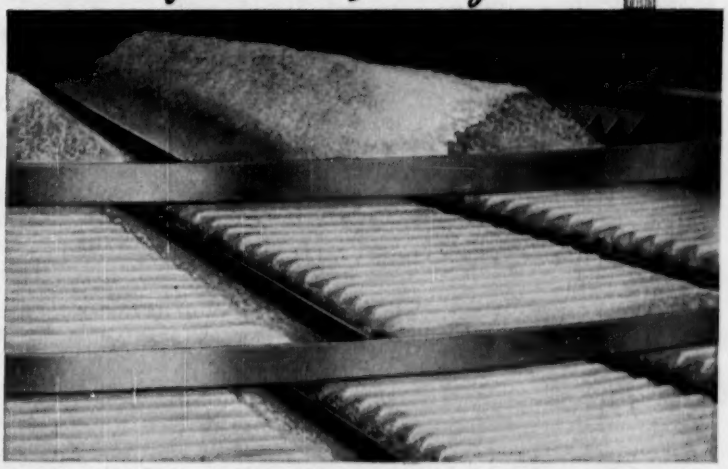
Hafnium's very high neutron cross-section makes it a good material for shielding and for control rods. (AEC requires in its zirconium contracts that equivalent byproduct quantities of hafnium also be delivered.) In addition to good corrosion and mechanical properties (comparable to those of zirconium),

HOW TO BE GENTLE



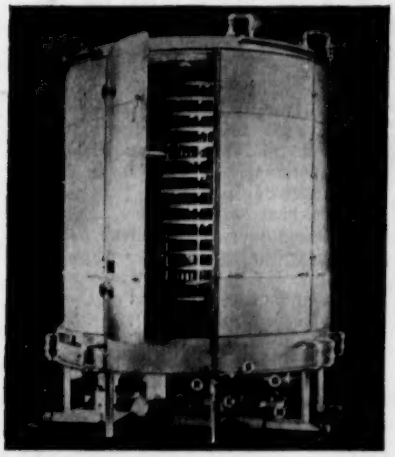
..... with the product you dry

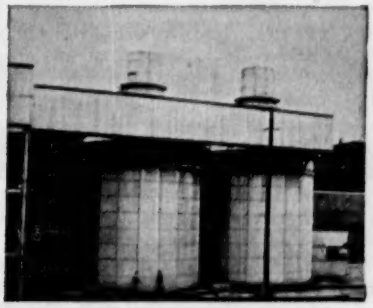
If you have a product which must be dried uniformly with minimum degradation of particles and without overheating . . . then you will be interested in learning about the Wyssmont approach.



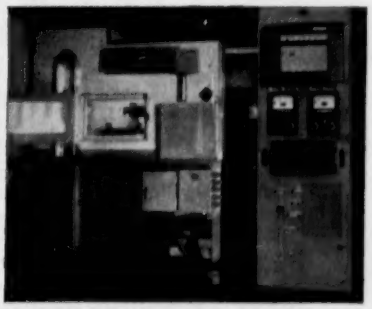
UNIFORMITY AND NON-OVERHEATING are accomplished by mixing and exposing new surfaces to the drying medium. The Wyssmont TURBO-DRYER® achieves this *without degradation* by intermittent and gentle piling and spreading of the product.

SLOWLY, GENTLY, fixed wipers slide the product off one tray to another only a few inches below, where fixed levelers spread it into serrated rows. This is repeated once on each tray shelf. Thus ALL the product is moved positively through exactly the same drying conditions in exactly the same time. ***No other drying system provides this combination of Blending with Equal Environment and Positive Displacement!***





SEE FOR YOURSELF the proof of performance in many Wyssmont TURBO-DRYER® installations in leading companies' plants, from the 5-story units shown above to smaller package units like the one on the left.



EXCLUSIVE NEW LABORATORY TEST-DRYER developed by Wyssmont provides comprehensive facts and figures on which to base performance. It records essential information unobtainable in any other way.

FOR A LOAN of a sound-and-color film, or for literature about the TURBO-DRYER®, write today to: Wyssmont Company, Inc., 42-01B 27th St. (Bridge Plaza South), Long Island City 1, N. Y. Representatives in principal cities.

TURBO DRYER

WYSSMONT COMPANY, INC.

DRYING & PROCESS ENGINEERS

The Wyssmont TURBO-DRYER® is applicable to continuous drying with SOLVENT RECOVERY, continuous purification by SUBLIMATION, continuous SOLID-GAS REACTIONS, and as a DRYER-COOLER.

Output of New Metals: Big Push Starts This Year

Plants	On Stream	Current Output (Lb./Yr.) For AEC	For Industry
ZIRCONIUM-HAFNIUM[1]			
Bureau of Mines, Albany, Ore.[2]	1950	300,000	100,000
Carborundum Metals, Akron, N. Y.	1953	325,000	
Carborundum Metals, Parkersburg, W. Va	1957	500,000	700,000
U. S. Industrial Chemicals, Ashtabula, Ohio	1957	1,000,000	1,000,000
Columbia-National Corp., Pensacola, Fla	1957	700,000	800,000
Wah Chang Corp., Albany, Ore	1957		700,000
BERYLLIUM			
Brush Beryllium, Luckey, Ohio[3]	1949	[4]	[4]
Brush Beryllium, Elmore, Ohio	1958	100,000	50,000
Beryllium Corp., Ashmore, Pa.	1957	100,000	50,000
COLUMBIUM			
Fansteel Metallurgical Corp., North Chicago, Ill	1955	[4]	[4]
Wah Chang Corp., Albany, Ore	1957	7,500	
Kennametal Corp., Latrobe, Pa	1957	7,500	

[1]Commercial-grade zirconium contains about 2% hafnium. This must be separated from zirconium ticketed for AEC use. [2]Operated since 1956 by Wah Chang Corp. [3]AEC Plant. Shut down 1953–56. [4]Undisclosed.

hafnium has a high thermal conductivity.

USI looks for hafnium to break into commercial nuclear markets late this year at a price of $25/lb.

▶ **Beryllium: Strong Yet Light**—While beryllium is not a "new" metal, its pre-atomic existence was chiefly in the form of beryllium-copper alloys. Now beryllium's versatile role in nuclear energy is stimulating large scale production of pure metal, with two new plants due to start up soon. Beryllium Corp. and Brush Beryllium are each scheduled to deliver 150,000 lb./yr. for the next five years.

Beryllium is light in weight (specific gravity is 1.85), has a relatively high melting point (2,340 F.), high strength and modulus at elevated temperatures, and low neutron cross-section.

Nuclear reactors can use beryllium hardware in several ways, such as a moderator, reflector or neutron source. Because of its high cost, however, beryllium will be used sparingly in commercial nuclear reactors, says W. W. Beaver, director of research for Brush Beryllium.

AEC will be paying initially $47/lb. for the ingot metal it buys under the new contracts; machined shapes will run $60-100/lb. Speculation says such costly metal is probably ticketed for nuclear-powered aircraft where beryllium's light weight would be a distinct advantage.

Beryllium's high stiffness-weight ratio suggests non-nuclear usefulness as well. Beryllium aircraft structures would weigh less than half as much as those of aluminum, according to a recent study by the Rand Corp. Unfortunately, low ductility of today's beryllium products limits the metal's structural value.

▶ **Columbium Defies Heat**—Newest of the nuclear metals is pure columbium (niobium). This metal, usually produced as the ferroalloy, is well known to chemical engineers as the stabilizer in Type 347 stainless steel.

AEC bought several thousand pounds of columbium recently, has current contracts with Kennametal Corp. and Wah Chang Corp. for 7,500 lb. apiece. Fansteel Metallurgical Corp. reports it has sold "substantial quantities" of pure columbium for use in experimental thermal reactors, such as the boiling-water type at Argonne National Laboratory.

Columbium offers superior heat and corrosion resistance. Although much of its significance to nuclear energy is still shrouded in secrecy, columbium is known to be suitable for cladding cores of fast reactors and for alloying with uranium to make fuel elements.

Like other nuclear metals, columbium looks for non-nuclear markets. Most promising of these, such as aircraft jet engines, will capitalize on columbium's resistance to high temperatures.

And as with the other metals, cost will be a major hurdle. AEC is now paying $55-67/lb., but inevitable progress in process technology together with increasing production will no doubt lower the price considerably—perhaps into the $10-12 range. This might, in turn, eventually lead to market volumes comparable to those of titanium—10,000–15,000 ton/yr.

Nowhere have the repercussions of nuclear energy been greater than in the field of metals. One of their prime functions, of course, is as a structural material. This is the basis of our story. Yet metals serve the nuclear industry in several other ways.

- Fuels—The entire nuclear industry depends on the release of energy by the fissioning of uranium 235, present in natural uranium to the extent of 0.7%. This is true even if the energy delivered from the system actually comes via the fission of plutonium and thorium-derived uranium 233, or the fusion of hydrogen (triggered by fission).
- Coolants — Sodium (or sodium - potassium alloy) serves as heat transfer agent in several operating and projected nuclear reactors. Lithium may find similar use because of its light weight.
- Reducing agents — Sodium and magnesium are reducing agents in the manufacture of zirconium, beryllium and uranium.



To meet the growing demand for Alcoa® Aluminum Electrical Rigid Conduit, all sizes are being stocked in distributors' warehouses for fast shipment anywhere. Fitting manufacturers make a full aluminum line.

And why the demand?

Here are just a few of the reasons:

- Corrosion resistant . . . needs no maintenance painting.
- Two-thirds lighter than steel; saves work and freight.
- Easier to cut, bend, thread, install; factory-applied internal lubricant makes wire pulling easier.
- Large sizes cost less than steel; all sizes competitive when labor savings and other advantages are included.
- Nonsparking . . . Underwriters' Laboratories approved.
- Up to 20% less voltage drop.

Your local Alcoa sales office has all the facts on advantages of aluminum conduit and can provide technical advice. For additional information and a free sample, fill in and mail coupon below.

ALCOA ALUMINUM CONDUIT
ALUMINUM COMPANY OF AMERICA

Underwriters' Laboratories, Inc. INSPECTED
RIGID CONDUIT
ISSUE MC-36

Your Guide to the Best in Aluminum Value

THE ALCOA HOUR—
Television's Finest Live Drama,
Alternate Sunday Evenings

Aluminum Company of America
2324-J Alcoa Building
Pittsburgh 19, Pa.

Please send literature on *Alcoa Aluminum Electrical Rigid Conduit* and a one-foot sample.

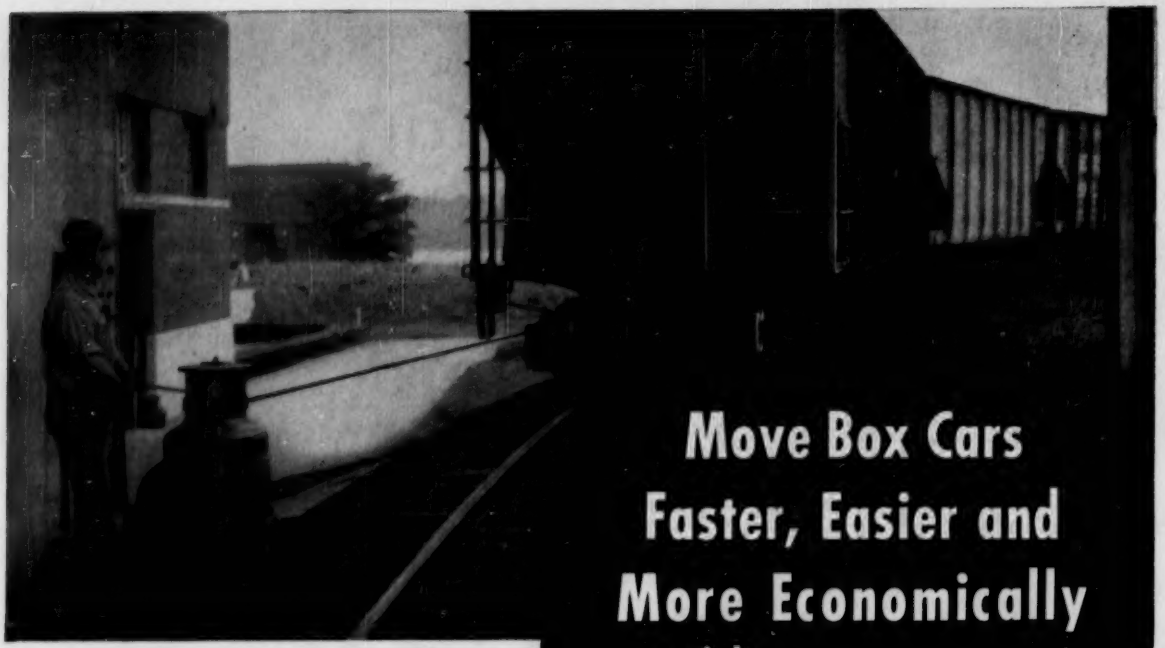
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Move Box Cars Faster, Easier and More Economically with...

STEPHEN S-A ADAMSON CAR PULLERS

Stop wasting valuable time and effort . . . powerful S-A Car Pullers eliminate the ineffective, slow and "back-breaking" use of pinch bars and allow the use of tow-trucks and tractors for the duties they were designed for. Saves you time, man-power and money . . . one man with an S-A Car Puller can spot up to 6 fully loaded box cars quickly, easily and safely. An ideal, cost-saving unit for any type installation, large or small, that requires the safe, swift movement of box cars.



S-A Car Pullers are available with Vertical capstans that will pull from any direction, or with Horizontal capstans that pull from two directions and may be used for emergency lifting. There's a type and size designed to meet your exact requirements.

IN STOCK FOR IMMEDIATE DELIVERY!

—WRITE TODAY—

. . for complete information.
Request Bulletin 753



Lift heavy loads quickly & easily with...

(S-A) WINCHES

S-A Hand and Motor Winches are designed to give you dependable, trouble-free lifting-power when and where you need it. S-A offers a type and size, in stock, to meet your specific job need. Get the facts on how these sturdy winches will help you to increase efficiency and lower costs . . . write for Catalog 853.

STANDARD PRODUCTS DIVISION
STEPHEN S-ADAMSON MFG. CO.
3 Ridgeway Ave. Aurora, Illinois

Remarkable resistance to heat and harsh chemicals

PROPERTIES OF "ARMALON" FELTS

GENERAL

Highly resistant to strong acids and bases at all temperatures.

Unaffected by water, common fuels, lubricants, hydraulic fluids, solvents.

High anti-stick properties.

Low coefficient of friction.

For FILTERING MATERIALS—tetrafluoroethylene felts

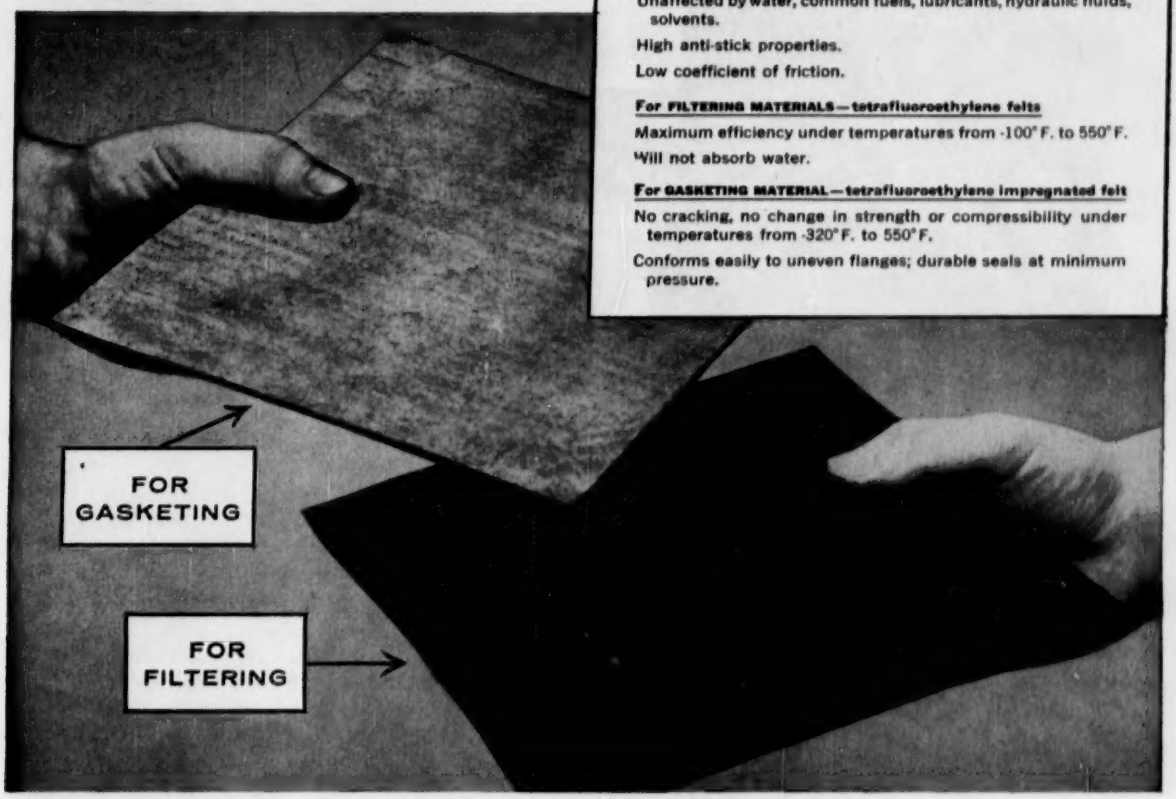
Maximum efficiency under temperatures from -100° F. to 550° F.

Will not absorb water.

For GASKETING MATERIAL—tetrafluoroethylene impregnated felt

No cracking, no change in strength or compressibility under temperatures from -320° F. to 550° F.

Conforms easily to uneven flanges; durable seals at minimum pressure.



New ARMALON® felts show exceptional service life in strong corrosives, temperatures up to 550° F.

Corrosion-resistant filters and gaskets of new "Armalon"* tetrafluoroethylene resin assure extraordinary long life felts where other materials fail entirely. They've proved their superiority in systems handling strong acids and bases—at temperatures from -320°F. to 550°F.

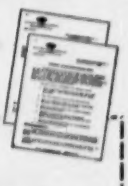
"Armalon" is the new felted form of Du Pont's "Teflon"** tetrafluoroethylene resin, available in two constructions—one for filtering, the other impregnated for gasketing†. "Armalon" is inert to water, common fuels, lubricants, hydraulic fluids, solvents and corrosive chemicals.

FILTERS of "Armalon" remove fine particles at high flow rates with minimum pressure drop. Anti-stick property of "Armalon" means longer service life, easier cleaning.

GASKETS of "Armalon" seal securely and last months, even years, longer than other materials. Advantages include substantial reductions in costly replacement shutdowns.

For more facts that may help you find a place for "Armalon" felts in your operations, fill out and mail the coupon. You'll receive Du Pont's free descriptive bulletin, including specifications.

*"Armalon" is Du Pont's registered trademark for its tetrafluoroethylene felts and impregnated felts.
**"Teflon" is Du Pont's registered trademark for its tetrafluoroethylene fiber.
†"Armalon" tetrafluoroethylene impregnated felt is covered by U. S. Patent 2,764,506.



DU PONT INDUSTRIAL COATED FABRICS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Fabrics Division, Dept. CE-9
Wilmington 98, Delaware

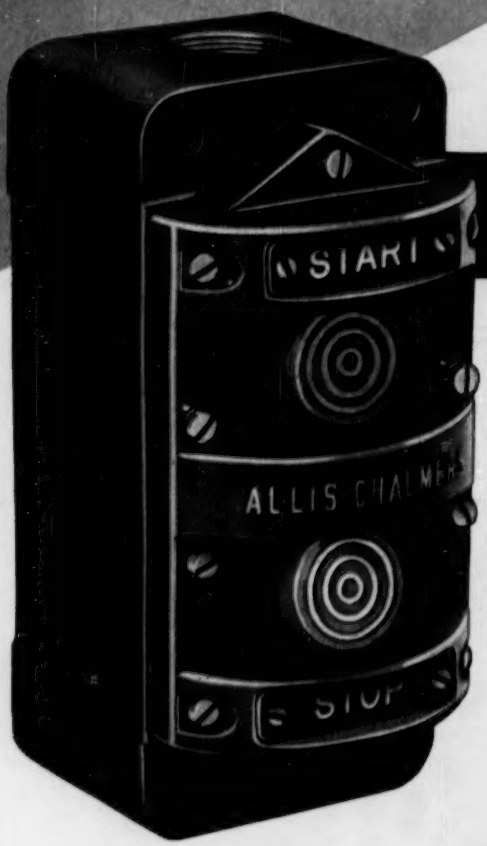
Please send me descriptive bulletin on "Armalon" felts.

Name_____ Position_____

Company_____

Address_____

City_____ State_____



NOW
from Allis-Chalmers

Pushbutton stations designed to withstand even the most Corrosive Conditions

Here is one of the most practical developments to come along in recent years—Allis-Chalmers heavy duty pushbutton stations. From the phenolic BM-2498 enclosure to the Type 316 stainless-steel hardware, this line of pushbutton stations is exceptionally resistant to corrosive action of chemicals.

For the first time a proven-in-service, roll-action operator is completely protected by a rugged, corrosion-resistant enclosure. This assures longer, trouble-free operation in chemical plants, refineries, paper mills, or any industrial application where corrosive atmospheres normally cause pushbutton failures.

The complete line of Allis-Chalmers corrosion-resistant pushbutton stations includes:

- single or two-button units
- momentary or maintained contacts
- lockout attachment
- pilot lights

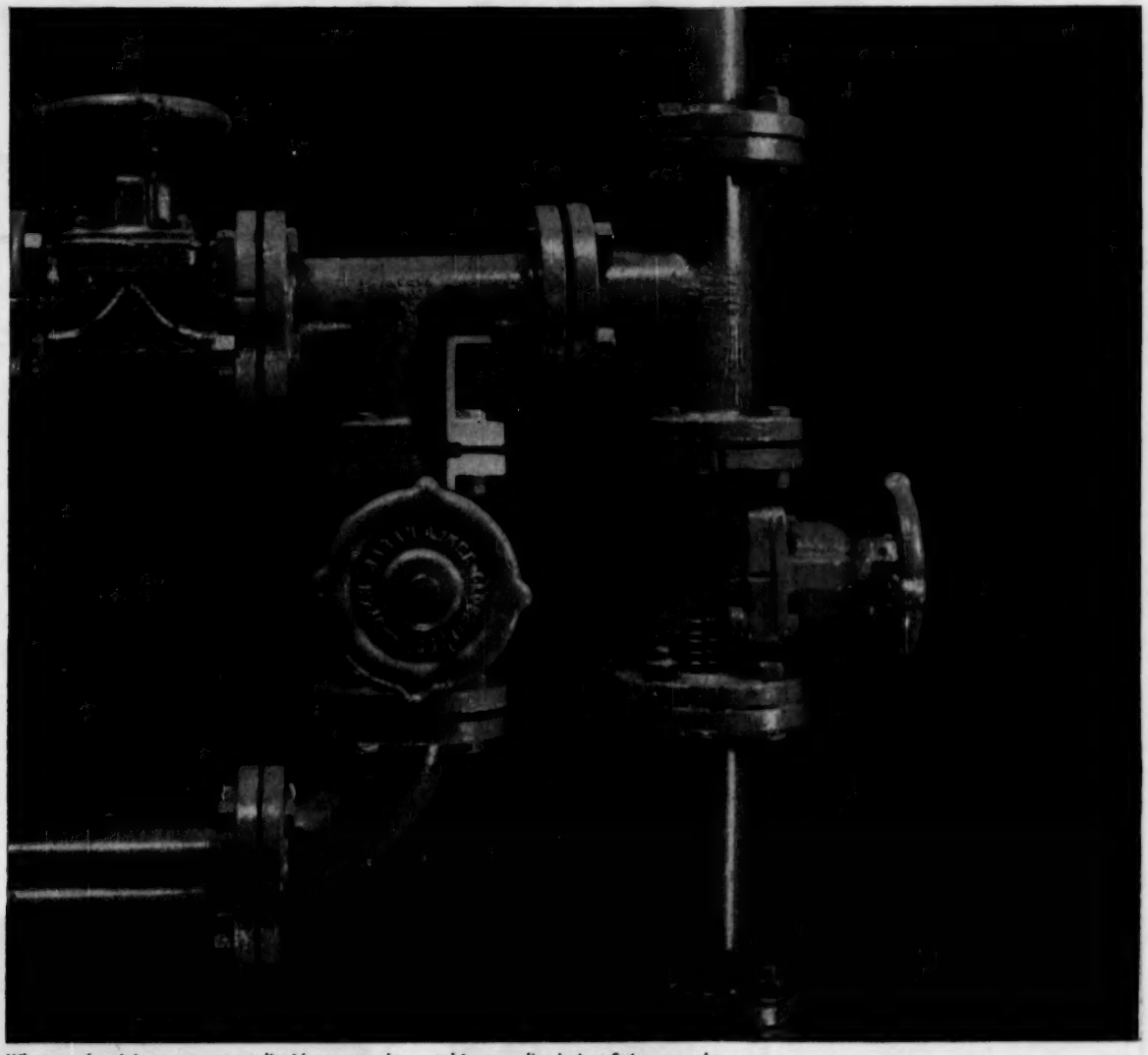


This newly designed pilot light has the same phenolic enclosure as the pushbutton stations, and is available as either single or double units. Wide angle lenses of flexible vinyl plastic have greater range of visibility, and are available in any combination of red, green, amber, blue, or white. Bayonet-type bulbs are used to resist shock. Primary voltages are to 550 volts; secondary voltage is 6.3.

For further details call your nearest A-C District Office or Distributor . . . or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5526



Whatever the piping arrangement, liquid never touches metal in saran lined pipe, fittings or valves.

You can see why saran lined pipe cuts costly downtime

It's a rigid steel pipe lined with durable saran that corrosive liquids won't bother

Now you can pipe commonly used acids, alkalies and other corrosive liquids without worrying about corrosion. With saran lined pipe, the liquid never touches metal – in the pipe, valves or fittings. Corrosion can't get a start–downtime troubles are eliminated.

Because it is two pipes in one, steel swaged onto saran, it has high strength. In fact, saran lined pipe will withstand working pressures up to 300 psi. Saran lined valves and fittings are available for 150-psi and 300-psi working pressures.

You'll get other advantages when you use saran lined pipe. It's easy to fabricate and easy to install. Conventional pipe fitters' tools can be used for cutting and threading. And you can hang it as you would ordinary steel pipe.

If your operation can profit from long-lasting, corrosion-free piping, investigate saran lined pipe today. THE DOW CHEMICAL COMPANY, Midland, Michigan.

SARAN LINED PIPE COMPANY
DEPT. SP1594A
2415 BURDETTE AVENUE
FERNDALE 20, MICHIGAN

Please send me information on saran lined pipe, fittings and valves.

Name_____ Title_____ Company_____

Address_____ City_____ State_____

YOU CAN DEPEND ON DOW

LOOK WHAT

'American-Microsen' Electronic

ELECTRONIC TRANSMITTERS

"Complete" is the word for the line of 'American-Microsen' Transmitters. You can select units for pressures up to 50,000 psi and all temperature ranges, as well as for flow, level, pH and all the electrical measurements.

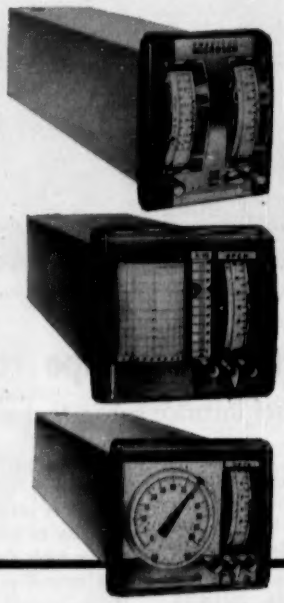
These instruments can transmit up to 30 miles in a split second, and the dc signal is most accurate and trouble free. They are compatible with practically all data logging and computer systems and extremely easy to install and maintain.



ELECTRONIC CONTROLLERS

. . . and here's the new 'American-Microsen' Controller. You have a choice of three plug-in units – a vertical scale indicating controller, a recording controller, and a round-scale indicating controller that can be interchanged with the recording type in seconds.

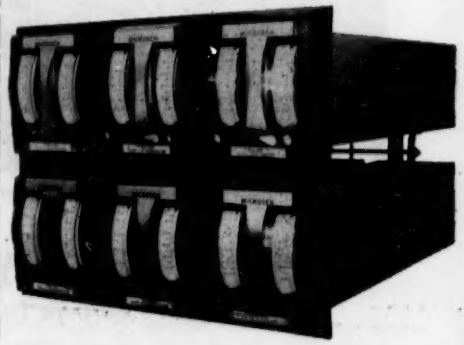
All components are in a single housing. Equally important, the controller is transistorized for greatest reliability and long service life. All control modes – proportional, rate, reset, cascade, etc. –are available.



MULTI-UNIT GROUPINGS

Now, here's a new idea that helps cut the cost of your panels and even your control rooms. You can "cluster" a whole group of controllers and recorders in a single unit. The group mounts on a standard relay rack and occupies an absolute minimum of panel space.

There's no clutter of wires and pipes behind the panel – with the 'American-Microsen' System! Even with the controllers mounted so close, the installation is clean and easy to service.



MANNING,

MAXWELL MANNING MM&M MOORE INC. TRADE MARK

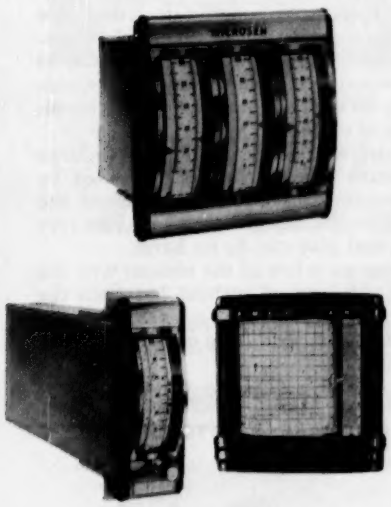
'AMERICAN-MICROSEN' . . . the all-electronic system of miniature-type instruments that provides the ultimate in process control, product quality and total economy.

YOU GET in the
Transmission and Control System

VERSATILE . . . INTERCHANGEABLE

Take a look at this vertical scale indicator. It can have one or two separate pointers on a single scale and comes in multi-unit enclosures to take up the least possible space on the panel.

Talk about a neat package – this slim manual valve operating station is it! It uses the same components as the controllers. You can be sure the 'American-Microsen' Electronic Transmission and Control System offers a whale of a lot in interchangeability.

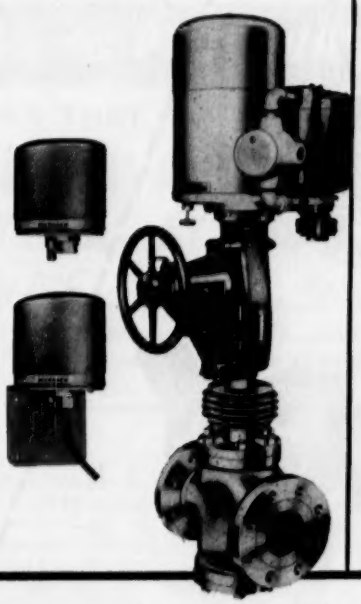


TRANSDUCERS . . . VALVE OPERATORS

You can operate pneumatic diaphragm valves with these transducers – or you can use the self-contained electro-hydraulic valve operator and eliminate all air.

The electro-pneumatic relay has a built-in booster to give a capacity of 8 cfm. That's the highest of any!

The 'American-Microsen' electro-hydraulic valve operator will stroke all valves up to 16 inch and larger. It delivers up to 3250 lbs. of thrust. *No other in its price range compares with that!*



SEE

OUR EXHIBIT AT THE

I.S.A. SHOW

Convince yourself! See the 'American-Microsen' Instruments at the ISA Instrument-Automation Conference and Exhibit. Visit Booths 932-936-938-940 at the Cleveland Auditorium, Cleveland, Ohio – September 9th through 13th.

If you can't make the ISA Show, write for literature and ask a sales engineer from our nearby district office to call and explain the advantages of 'American-Microsen' Instruments for measurement, transmission and control. You will not be obligated in any way.

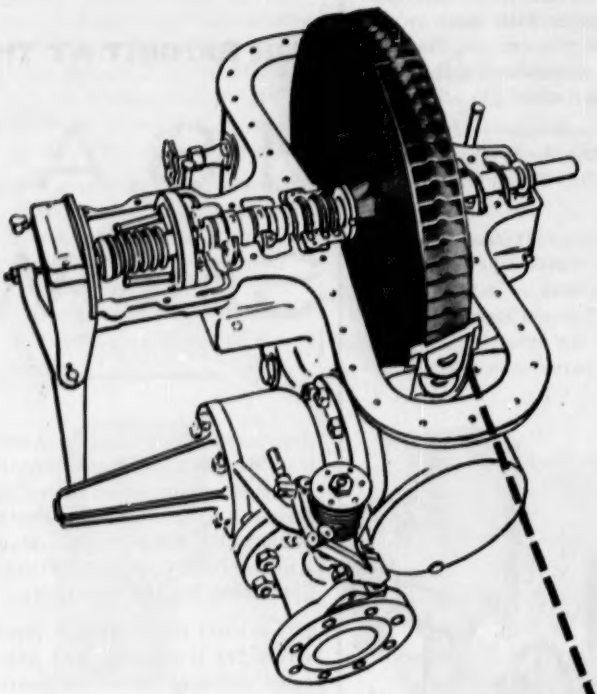
MAXWELL & MOORE, INC.

INDUSTRIAL CONTROLS DIVISION

Stratford, Connecticut

MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

Work Horse of Industry..since 1906



The Terry Steam Turbine Company was incorporated in 1906 to manufacture *a workable and efficient prime mover that would operate with minimum maintenance.* This prime mover was the solid-wheel turbine, which had been invented by Edward Clinton Terry a few years before.

Although maintenance practice has improved vastly since then, the demand for the turbine has multiplied many times. *Rising maintenance costs have actually increased the need for trouble-free operation.*

Today, there are more Terry solid-wheel turbines in operation, and there are more built each year, than ever before. The explanation is simple.

Here is a turbine with a virtually indestructible wheel. Made of a single forging of special composition steel, there are no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which may occur does not materially affect horsepower or efficiency.

Blades will not foul. They have large clearances and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

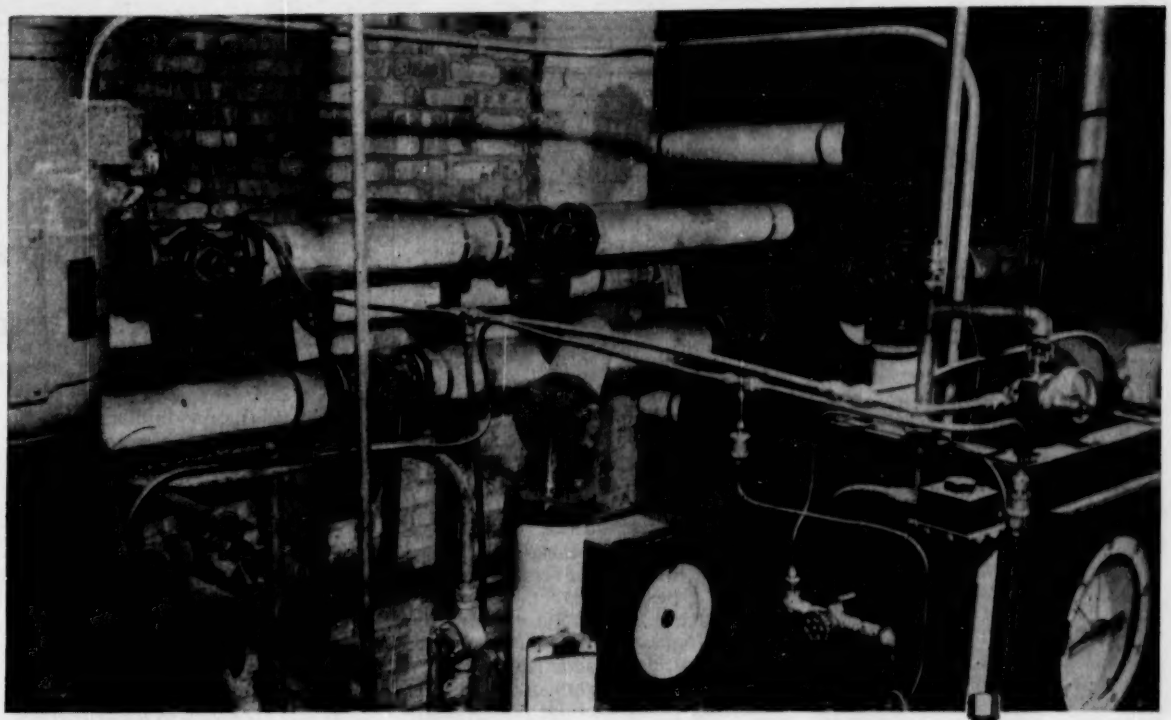
These are a few of the reasons why the Terry solid wheel turbine has been the *work horse of industry – since 1906.* For the full story, send for a copy of Bulletin S-116.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

TERRY



1906 was the year this turbine was built in Terry's plant. It is believed to be one of the first small direct-connected turbines built for commercial use in the United States.



The T. F. Washburn Company uses...

HOMESTEAD *Lubricated* PLUG VALVES

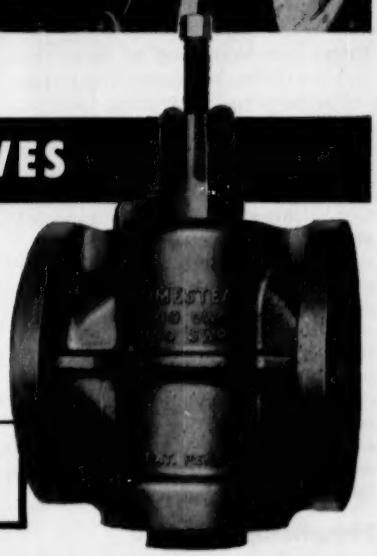
ON LINES THAT

HANDLE HOT VARNISH AND RESIN BASE MATERIAL AT 500° F.

BECAUSE....

1. Previous Homestead Installations Gave Excellent Performance

2. Homestead Engineering Representative Rendered Fine Service on Installation Layout



Excellent performance of Homestead Lubricated Valves in the control of Jelled Paint Products at T. F. Washburn Company, is guaranteed by built-in features, such as: 100% pipe area, and controlled pressurized lubrication. Used on lines to thinning tanks, these three-way Homestead Valves have the same area as that of the pipe line, and thus permit full flow with minimum pressure drop—an important advantage on the low operating pressure of less than five pounds per square inch. Also, the exclusive *controlled* pressurized lubricant system of Homestead Valves prevents contamination of line fluids or clogging of the low pressure lines with lubricant.

Exclusive features, such as these, guarantee long low cost service from *all* types of Homestead Lubricated Plug Valves. For full information, write for Reference Book 39-5. There is no obligation.

USE THIS TIME-SAVER COUPON IF YOU PREFER.

HOMESTEAD
VALVE MANUFACTURING COMPANY
"Serving Since 1892"
P.O. BOX 13 CORAOPOLIS, PA.

Without obligation, please send me Reference Book No. 39-5 covering Homestead Lubricated Plug Valves.

Name_____ Title_____

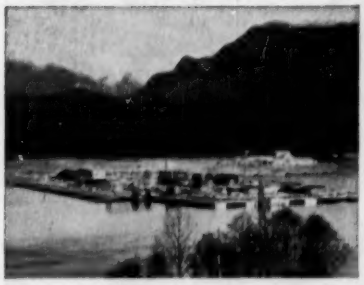
Company_____

Address_____

City_____ State_____

BRIEFS FOR BUYERS

about Caustic Soda • Phosphorus Chlorides • Potassium Chlorate, Perchlorate •



Chemicals for a growth area

Pulp, petroleum, and plywood are three of the main reasons why industry is popping in western Canada.

Fitting neatly into this growth picture is the new plant of Hooker Chemicals Limited, in North Vancouver, B. C. This plant is Canada's first chlor-alkali producing point west of the Rockies.

By rail and barge, it will supply caustic soda and chlorine for making and bleaching pulp; more caustic soda to help sweeten petroleum refinery products and to produce plywood adhesives.

Hooker customers around Vancouver will enjoy a freight saving on these chemicals, which formerly came into the area by sea-going barge from our Tacoma plant.

Phosphorus chlorides ... growing, growing

You will be hearing more about the Hooker phosphorus chlorides described below. Current trends in organic synthesis are creating a growing need for the properties they put at your command.

Phosphorus oxychloride, $POCl_3$, is something you'll want to investigate if you're developing organic phosphates or plasticizers, gasoline additives, or fire-resistant hydraulic fluids.

As a chlorinating agent, it neatly supplements and broadens your already wide choice of Hooker chlorine-containing compounds. It's used also as a catalyst for intermediates and dyestuffs, and in preparation of medicinals such as sulfa drugs.

A clear water-white liquid, it assays 99.5 minimum $POCl_3$ and contains no free chlorine or phosphorus pentachloride.

Phosphorus trichloride, PCl_3, has wide repute as a convenient entry to many types of organic synthesis.

You can use it as a chlorinating agent in manufacture of organic acid chlorides; as a condensing agent in preparation of organic aldehydes; in making phosphite and phosphonate esters; and as a catalyst in certain chlorination reactions.

It's a clear water-white liquid of 99.5% minimum purity.

If you're already buying either of these versatile products in quantity, or plan to do so soon, be sure your supplier has what it takes to get the material to you promptly. Both these chemicals require special handling; volume deliveries are usually made in lead-lined tank cars.

When you purchase from Hooker, you *can* be sure, because you have at your disposal the largest fleet in the country of these special cars.

For contract information, write us. For technical data sheets, just check the coupon.



How to save 5¢ a pound on sulfides

If you're buying sodium sulfide as a source of combined sulfur, here's a way to get the sulfur for about 5 cents a pound less.

Just switch to Hooker *sodium sulfhydrate*.

In 100 lbs. of sodium sulfide, you get about 24.6 lbs. of combined sulfur. The same weight of sodium sulfhydrate gives you about 40 lbs. of sulfur—about 62.6% more.

At prevailing prices, the sulfur in sodium sulfide costs you about $.224 a pound. In sodium sulfhydrate, it's only about $.169 a pound.

Your actual saving is larger than the difference—because sodium sulfhydrate contains less water of crystallization, so freight cost is lower.

If this approach to lower-cost sulfidity looks like a good one for you, why not explore it with your Hooker salesman? He'll gladly help you review the facts with your specific needs in mind.

Facts on caustic potash

While there are a few growing uses for dry forms of caustic potash (notably the powder and flake), about 8.5 out of every 10 pounds of KOH purchased in the U. S. are bought as liquid, either standard or low-chloride grade.

Reasons for this are pretty clear: liquid KOH is easier to handle than solid forms, and cheaper to buy (particularly in the higher concentrations).

Shipping strength of liquid KOH is limited, by its penchant for crystallizing in cool weather, to a narrow range between 45% and 52%. Big-volume users sometimes order 52% to keep freight cost down; this is about the practical limit on strength.

NIALK® liquid caustic potash is regularly shipped at 45% to 52% concentration. It is extremely low in iron content.

If your process economics favor a solid form of KOH, you can get a wide choice by specifying NIALK brand. We ship 90% caustic potash as fused solid, flake, granular, walnut, broken, powder, or crushed.

("Walnut" is used in liquefying air; flake and powder often go into cleaning compounds, mixed with caustic soda, soda ash, metasilicates, and phosphates.)

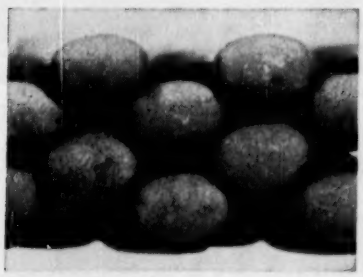
Sodium Sulfhydrate • Caustic Potash

Sodium Chlorate • Oxalic Acid • Other Chemicals

We also supply 85% KOH in flake or solid form.

KOH is a "specialty" alkali. You buy it for specific properties you just can't get from other alkalies. Making it takes special skills, too.

You can have confidence in the same skill that pioneered caustic potash on this continent and has supplied NIALK KOH for half a century. We continue to supply a major portion of the growing requirements of this country.



Specialization: extreme case

Maybe the point of this piece is that you never know how a Hooker chemical can help you—until you try it.

At any rate, we've just published new data sheets on two products you'll probably *never* buy. They're very useful, but very specialized.

One of them is Hooker *potassium chlorate*. There's a little of it in the heads of three out of every five safety matches made in this country.

The other is Hooker *potassium perchlorate*. Even more exclusive, it goes almost entirely into railway fusees and fireworks.

How our specialization can help you

Perhaps *your* need for a chemical is as specialized as this. Perhaps our new, wider diversity includes an *existing* product or process that can help you meet this need.

To find out, why not ask us?

More $NaClO_3$ coming

Thanks to our OLDBURY products plants at Niagara Falls, N. Y., and Columbus, Miss., we're presently the nation's largest producer of sodium chlorate. But even that isn't good enough to meet *tomorrow's* needs.

The Columbus plant has been in production since 1954. Last year we upped its capacity by 5,000 tons per year. Now we're building again. By early 1958, another 5,000 tons yearly will be on tap.

Assuming you're in the market for sodium chlorate, may we submit these three reasons for making Hooker your supplier:

1. Fastest service you can get east of the Rockies.
2. Skilled technical help when you need it.
3. Sodium chlorate of 99.5% minimum purity.

May we spell out these advantages for you in more detail? If so, just write.

New data on oxalic acid

To keep your technical file up to date, send for our newest publication on OLDBURY oxalic acid: Data Sheet No. 789.

It lists specifications, typical physical properties, packing data, uses, and handling precautions. For a copy, check the coupon.

New bulletin lists Hooker products

You'll find a complete up-to-the-minute listing of Hooker chemicals in this new 12-page bulletin. Indexed for ready reference, it lists the chemicals you can buy from us in commercial quantity, including chemicals sold under the NIALK and OLDBURY® brand names.



Under each product you'll find a short description and condensed listing of properties, actual and suggested uses, and shipping containers. The bulletin also sums up for you the major types of processing performed at Hooker.

If you'd like to have this up-to-date timesaver in your file or on your desk, just check the coupon for a copy of new *Bulletin 100-A*.

For more information on chemicals mentioned on this page, check here:

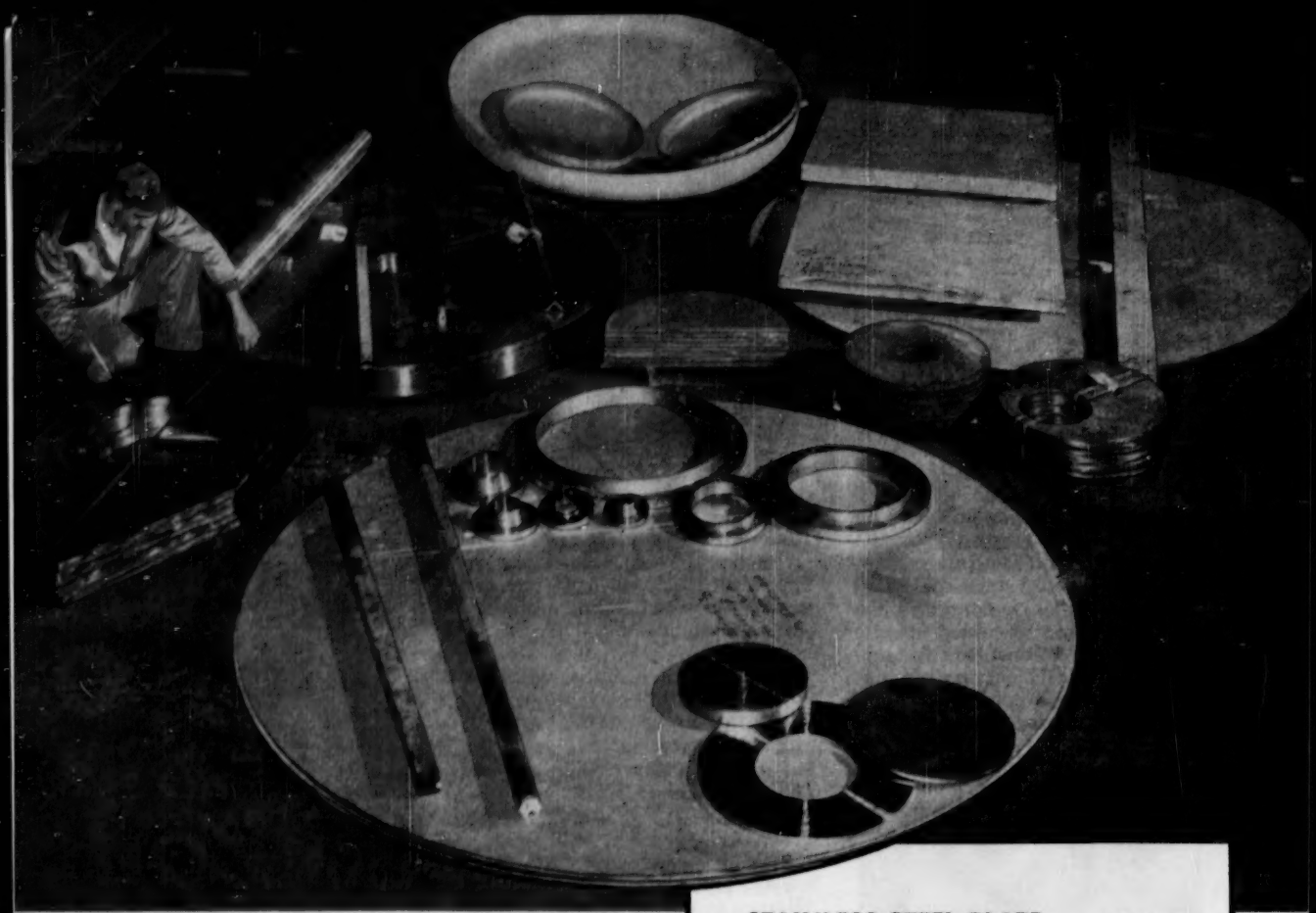
- ☐ Caustic Soda, liquid
- ☐ Caustic Soda, flake and solid
- ☐ Phosphorus Oxychloride
- ☐ Phosphorus Trichloride
- ☐ Sodium Sulfhydrate
- ☐ Caustic Potash
- ☐ Sodium Sulfide
- ☐ Potassium Chlorate
- ☐ Potassium Perchlorate
- ☐ Sodium Chlorate
- ☐ Oxalic Acid
- ☐ New list of products—Bulletin 100-A

Clip and mail to us with your name, title, company address. *(When requesting samples, please use business letterhead.)*

HOOKER ELECTROCHEMICAL COMPANY
409 FORTY-SEVENTH STREET, NIAGARA FALLS, N. Y.

NIAGARA FALLS • TACOMA • MONTAGUE, MICH. • NEW YORK • CHICAGO • LOS ANGELES

HOOKER CHEMICALS PLASTICS



STAINLESS STEEL

produced the way *you* want it by Carlson

Only at Carlson can you buy so many grades of stainless steel in the wide variety of shapes and sizes illustrated here. We regularly process such complete bill-of-material orders. Trained Carlson men, with years of experience and practical knowledge, are determined to give you the best and most efficient service possible.

When you need stainless plate . . . Carlson gives you what you want when you want it!

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Stainless Steels Exclusively

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Thorndale, Pennsylvania

District Sales Offices in Principal Cities

STAINLESS STEEL PLATE . . . rolled to almost any size or thickness, 3/16" and heavier, to meet your individual needs—whether rectangles, circles or special patterns. Substantial tonnage in Types 302, 304, 304-L, 309, 309-S, 310, 316, 316-L, 317, 317-L, 321, 347, 348, 405, 410, 430 and 502-½% Mo. is available for prompt delivery. In addition, two precipitation-hardening grades, Types 17-4 PH* and 17-7 PH* are now in production.

STAINLESS STEEL HEADS . . . in Types 304, 304-L, 316 and 316-L are available from stock in ASME and Standard specifications (10" to 72" diameter). A large assortment of dies is available for pressing other types of heads and special sizes can be spun where practical.

STAINLESS STEEL FORGINGS and SPECIAL PATTERNS . . . including tube sheets, flanges, circles, rings, sketch plates and other specialties can be produced to specification on our versatile equipment.

Also STAINLESS STEEL BARS AND SHEETS (No. 1 Finish).

*Trade mark of ARMCO STEEL CORPORATION

PLATES • PLATE PRODUCTS • HEADS • RINGS • CIRCLES • FLANGES • FORGINGS • BARS and SHEETS (No. 1 Finish)

HYDROGENATION CATALYSTS

How Girdler helps you solve hydrogenation problems





• There are three important cost-cutting ingredients in Girdler catalyst service for hydrogenation applications:

1. Girdler's *proven hydrogenation catalysts*, such as listed, which are providing optimum operating economy in a wide variety of uses.

2. Girdler's accumulated *technical know-how* which is constantly finding new solutions to difficult hydrogenation problems.

3. Girdler's extensive catalyst *facilities* . . . manufacturing, research, development and technical service . . . which provide the ideal catalyst for *your* application.

Outline your catalyst problem and we will make specific recommendations. Bulletin GC 1256 describes the full line of Girdler catalysts . . . available on request.

NICKEL CATALYSTS	Leaders in the generation and purification of synthesis gases, and for a wide variety of organic hydrogenations. Girdler's close control of reduction and careful selection of support materials impart unique properties for difficult process problems.
COPPER CHROMITE CATALYSTS	One of most highly active and versatile commercial hydrogenation catalysts. Available in regular and barium-stabilized types either as powder or especially strong pellets. Powder meets certain specific particle density requirements.
SELECTIVE HYDROGENATION CATALYSTS	Widely used to selectively hydrogenate acetylenic and diolefinic compounds in purification of olefins. Custom made to give optimum performance with due regard for process variables and contaminants. Facilitate production of high purity olefins for petrochemical processes.
COBALT MOLYBDENUM CATALYSTS	Used extensively by many refineries. Highly active. Developed specifically for sulfur conversion and for hydrogen treating to remove sulfur and nitrogen . . . also for upgrading a wide range of petroleum feed stocks. Excellent physical properties assure high operating economy and long life.
NOBLE METAL CATALYSTS	Pelletized forms of platinum and palladium catalysts for special applications. Advanced techniques produce highly active catalysts, economical both in manufacture and use.

CATALYST DEPARTMENT

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

GIRDLER MANUFACTURES CATALYSTS FOR: HYDROGENATION • SYNTHESIS GASES AND HYDROGEN GENERATION • DESULFURIZATION • NEW CATALYTIC PROCESSES

Here's Why . . .

Silicone Insulation Offers New Economy For Outdoor Motors

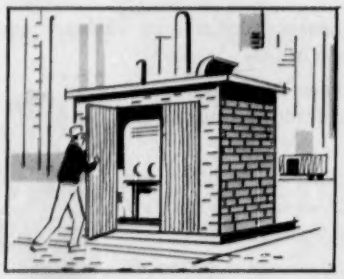
Silicone insulation is establishing a trend towards less costly enclosures for outdoor motors. By readily withstanding moisture and contaminants circulated in ambient air, silicone insulation makes possible more open enclosures and lower motor cost per horsepower.

Several leading electrical equipment manufacturers now offer a line of silicone-insulated "all-weather" motors in most large horsepower ratings.

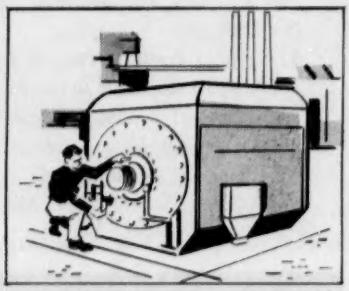
Safe, reliable operation outdoors the year 'round is assured by Dow Corning silicone insulation. Experience has shown silicone-insulated motors readily withstand torrential rains, hurricane winds, corrosive fumes, wind-driven dust, snow, sleet, cold and heat.

Long insulation life is assured by the water-repellent silicone-insulated windings that survive even flooding. Silicone insulation on motors, generators and transformers provides up to 50% greater service factor for absorbing overloads, adds immeasurably to reliable operation and increases insulation life 10 times or more. That's why it's wise to—

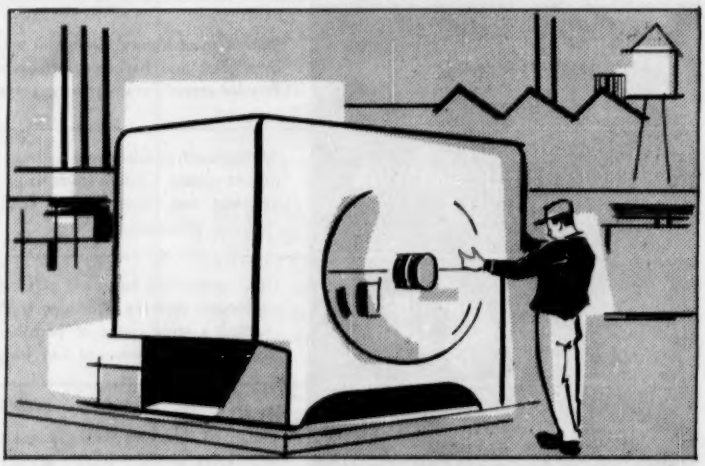
SPECIFY DOW CORNING SILICONES
and *Save*



Initially, motors were sheltered in buildings . . .



Later, motor enclosures themselves sealed out surrounding atmosphere

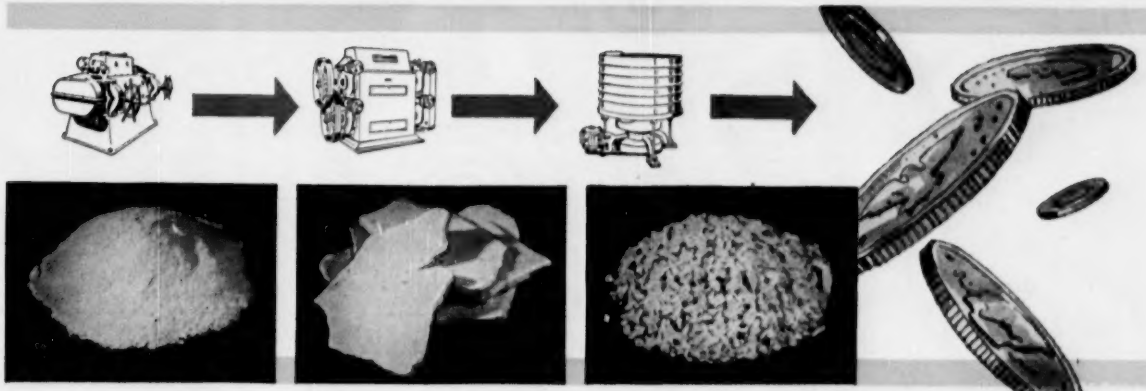


Now, silicones protect motor parts permitting the circulation of ambient air and lower-cost enclosures.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

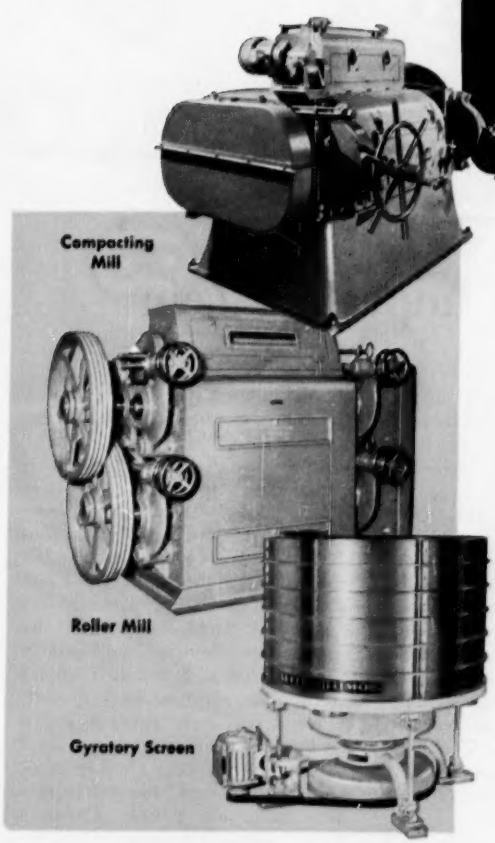
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Converts WASTE into PROFIT

ALLIS-CHALMERS
Compacting Process

it's mechanical
it's economical



You start with a pile of practically worthless material and wind up with a profit! Magic? Well, hardly – unless you want to call the mechanical efficiency of the Allis-Chalmers Process System magic.

How It Works

In a recent installation the conversion starts with an unusable, unacceptable minus 30 mesh chemical salt . . . fines created in the original process. An Allis-Chalmers compacting mill densifies these fines into flakes or slabs. Flakes are granulated in an Allis-Chalmers roller mill. Final separation is made in an Allis-Chalmers stainless steel gyratory screen. Result – 70 to 80% recovery of salable product. What's more – the resulting granules equal or surpass the natural product in every respect.

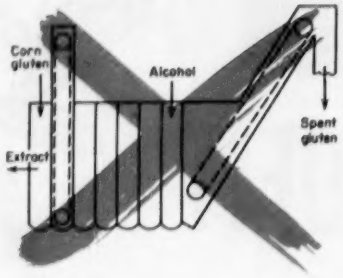
The entire system is mechanical; therefore, it's more economical than controlled crystal growth.

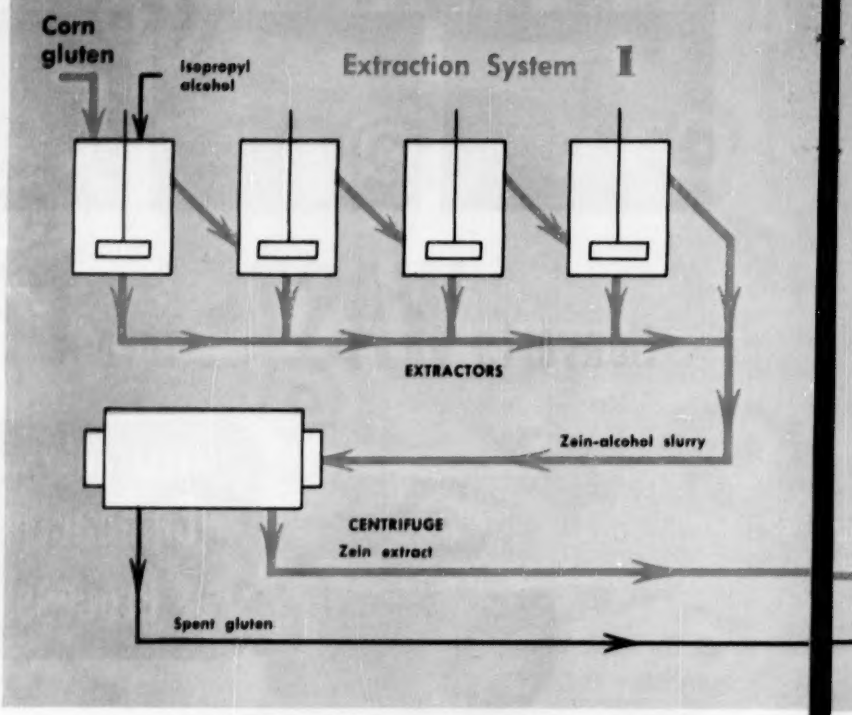
For More Information

Get the complete story from your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. Ask for Bulletin 25C6177J.

ALLIS-CHALMERS

A-5345





New solvent extraction stage steps in at Corn Products and gets tidy process economies.

Revamped Flowsheet Wins Improved Zein

"WHILE zein has been steadily booming as an essential raw material for a wide variety of industries,"* comments Corn Products Refining's H. O. Bensing, "we've seen many potential markets close to it because of its less satisfactory natural properties."

Thus challenged, Corn Products Refining Co. has now revamped its $6.5-million, 15-million-lb./yr. zein operation at Pekin (near Peoria), Ill. Results: (1) a modified product that meets the stiffest property requirements of new industrial applications and (2) an improved process that offers hefty capital and operating savings.

Chief product gains include greater uniformity and increased stability with the elimination of incipient denaturation. Too, the usual tendency of zein solutions to increase in viscosity, then gel, has been halted.

And, Bensing points out, process operating time has been slashed, reagent consumption has been cut 30% and yields boosted 20%. Maintenance costs have been lowered markedly; plant design and operation considerably simplified.

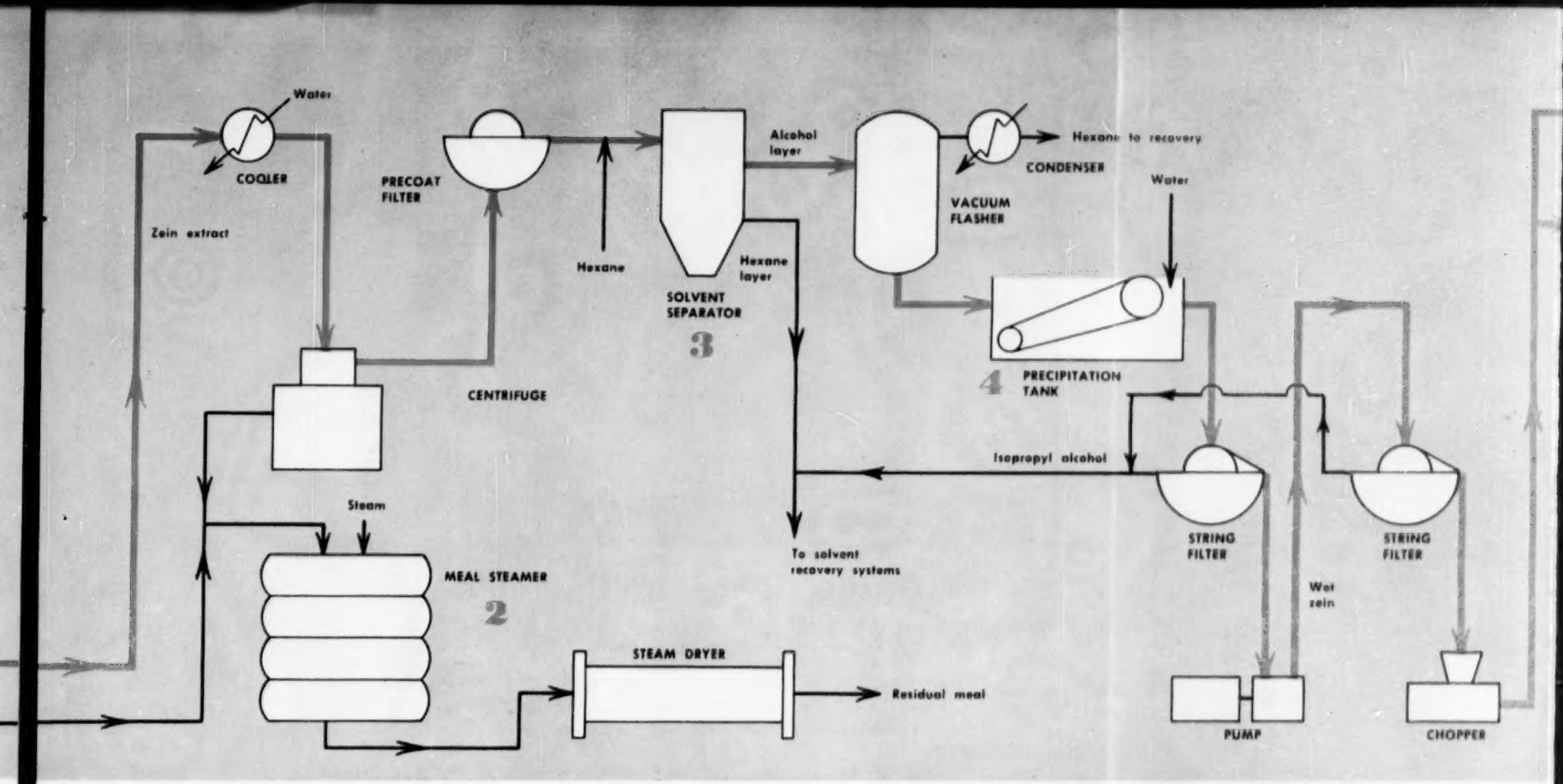
▶ **Key Process Change** — The key change CPR made was at the extraction stage. There, a new, $60,000 solvent extraction system replaced a seven-cell extractor. Here's why:

Zein, the alcohol-soluble protein (promaline) of corn, is derived from corn gluten—a primary product from the wet milling of corn. Formerly it was extracted by carrying the gluten in a bucket elevator from cell to cell down the seven-cell extractor through a counter-current, gravity flow alcohol stream. Spent gluten discharged via an inclined drag elevator.

But this extraction scheme posed a slate of problems. Elevators and drag unit demanded constant maintenance. Each shutdown and startup meant 3-4 hour lost time to regain the proper equilibrium conditions in the unit. Then, if the unit wasn't completely emptied during shutdowns, the zein extract gelled and zein precipitated to spoil yields. And this precipitated zein would "seed" the entire system to create pesky gels even after the unit was back on stream. Too, extraction time was unhappily high at 3½ hr.

▶ **New Extraction System**—CPR engineers considerably eased these problems with four series-hooked, agitated extraction tanks

*Over 14 million lb. of zein in 1956 all from sole zein producer Corn Products Refining, served in the manufacture of protein fibers (e.g., Vicara), varnishes, printing inks, cork binders.



operating in conjunction with a centrifuge. Now boiling alcohol and gluten meal travel cocurrently down the extraction line, overflowing from tank to tank. Slurry from the last tank is separated in the centrifuge, spent meal going to waste and alcohol extract to zein recovery.

This approach reduced extraction time from 3½ to ½ hr. while boosting extraction efficiency some 20%, according to Bensing. And it cut solvent losses 30% thanks to the elimination of elevators and drag units. Too, elevator and drag unit maintenance was eliminated. Further, any startup or shutdown now takes under ½ hr. since balancing of countercurrent streams is no longer necessary. And gel formation has been sidestepped.

▶**How Process Works** — Corn gluten (at −20 to +70 mesh) from the corn wet milling operation at Pekin enters the first of the four 400-gal., series-hooked steel extraction tanks. Each tank is felt insulated and equipped with a 2-hp., 84-rpm. agitator.

Aqueous isopropyl alcohol (86% by volume), just below its boiling point (190 F.), joins the meal in the weight ratio of 4:1. Agitated slurry overflows from tank to tank and zein dissolves in the alcohol. From the last tank, the slurry goes to a solid-bowl centrifuge fitted with an alcohol spray to wash out residual extract.

▶**Gluten Treatment** — Spent meal from the centrifuge, containing 35-45% alcohol, discharges to a meal steamer. A steel, steam-jacketed screw conveyor, this unit replaces alcohol in the gluten with water by the direct injection of 60-psi. steam.

Gluten then feeds through a steam (20 psi.) tube dryer where 160-F. temperature reduces its moisture content to 10%.

▶**Clarifying Zein Extract**—Hot, cloudy alcohol-zein solution from the centrifuge, containing 6 grams zein/100 cc. alcohol as well as materials that damage its stability and clarity, passes to a clarification stage.

First the extract is cooled in three copper-tube, shell-and-tube exchangers to about 75-80 F. Cooling water comes from a freon refrigeration system. At the low temperature, certain objectionable materials are insoluble and can be separated out in a centrifuge. Extract then goes through two precoat cotton-cloth filters with 560 sq. ft. filtering surface to remove particles that escaped centrifuge.

Oil is removed from the alcohol solution by extracting with hexane. Equal volumes of hexane and solvent solution mix in the pipeline. The two layers are separated in seven tubular-bowl, 13,500-rpm. centrifuges.

Upper hexane layer, with the oil and some alcohol, goes to a recovery system. Lower alcohol layer, containing zein and some hexane, goes to a steel, vacuum (23 in. Hg) flasher operating at 120 F. Final traces of hexane are driven off and condensed.

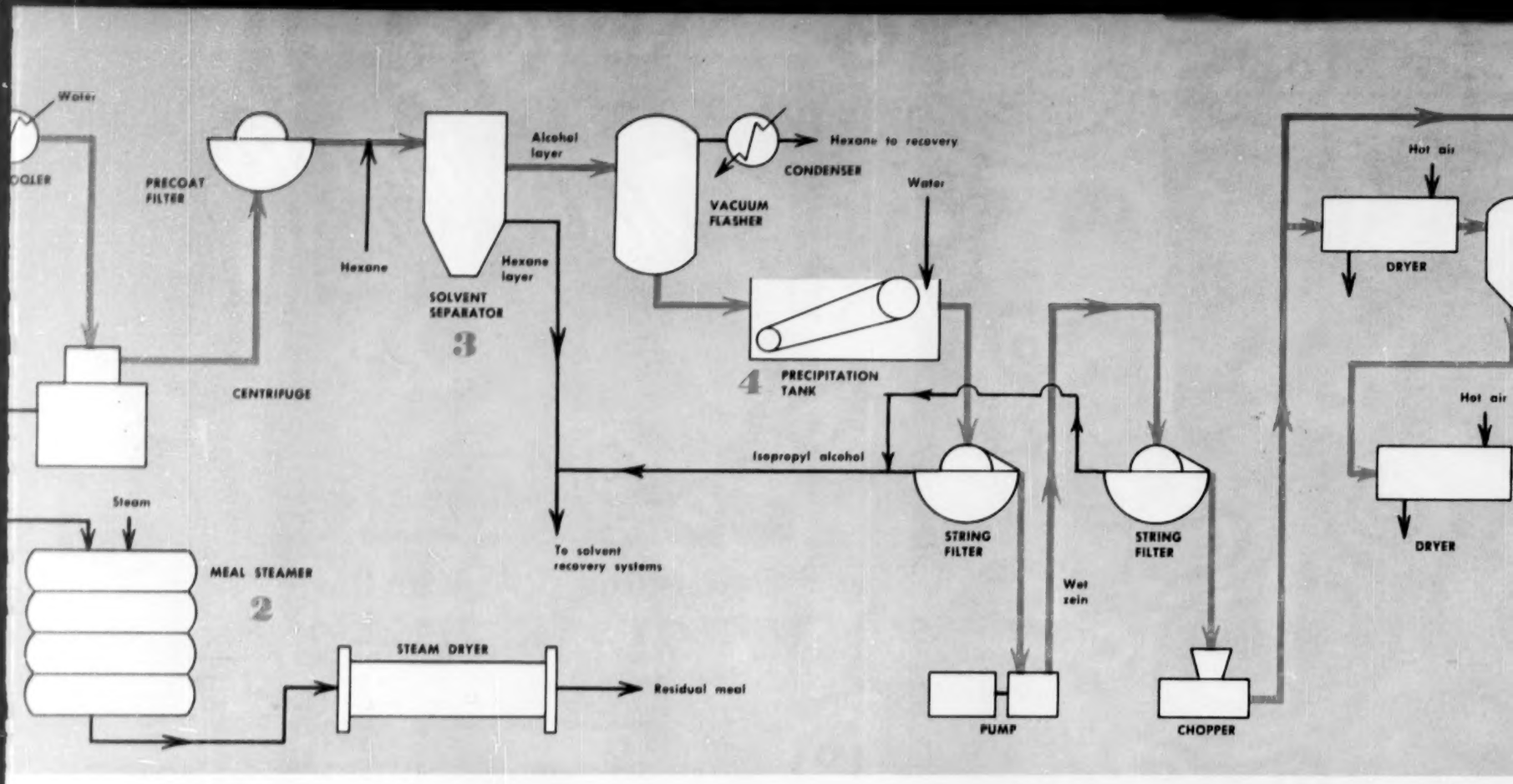
▶**Zein Recovery** — Alcohol-zein solution then feeds to a 2,500-gal., steel precipitation tank. There, it's injected into a fast moving stream of chilled (45-55 F.) water agitated by paddles. At the temperature and turbulence, zein precipitates from the solvent as long, spongy fibers. They are separated out and water washed in two string filters that provide a combined filtering surface of 400 sq. ft.

Alcohol content of the zein fibers is less than 1% from the filters, but they contain 60-65% water. First chopped to a powder, the wet zein feeds to a drying system. Steam-heated air at 320 F. and 4,000 cfm. through two parallel-hooked dryers lower zein water content to 30-35%. Zein is collected in galvanized steel cyclones. A third dryer, with 320-F. and 6,000-cfm. air, drops water content to 7-8%.

To prevent the zein from becoming gummy during packing, its temperature is dropped to 50 F. in a cooler with 40-F. air from ammonia coils. Product is then screened for oversize particles (+20 mesh) which are recycled through a small hammer mill.



2 MEAL alcohol



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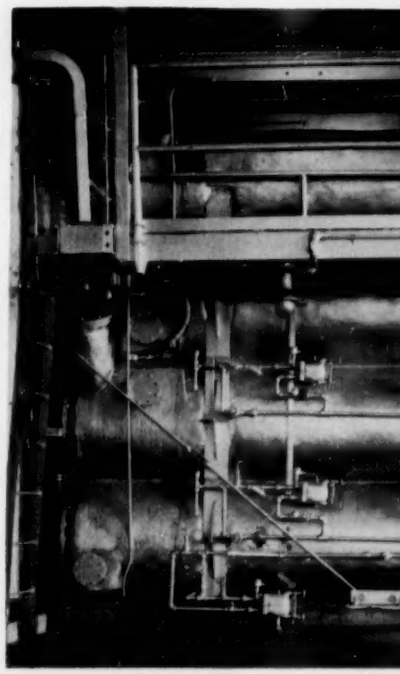
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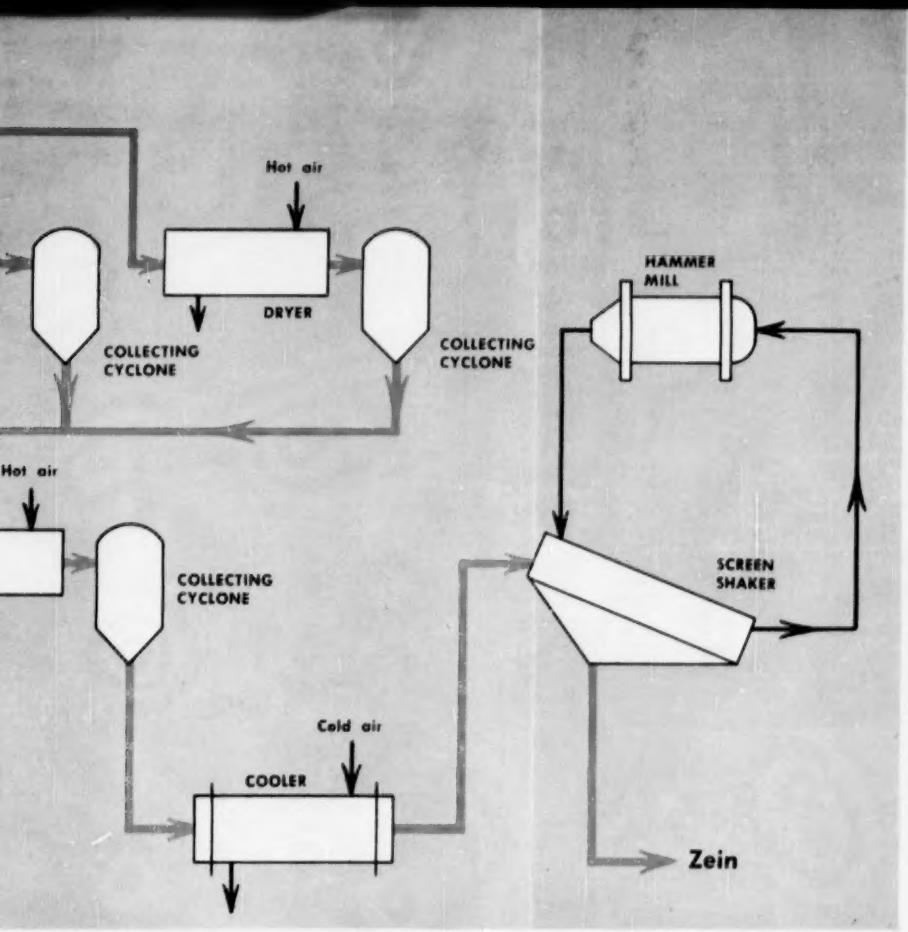
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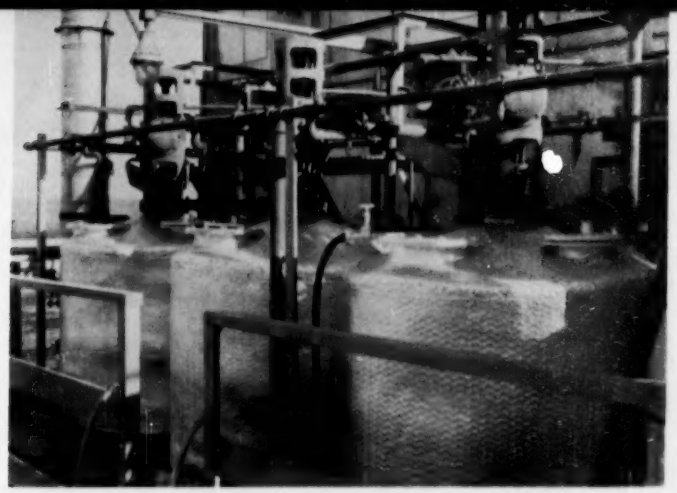
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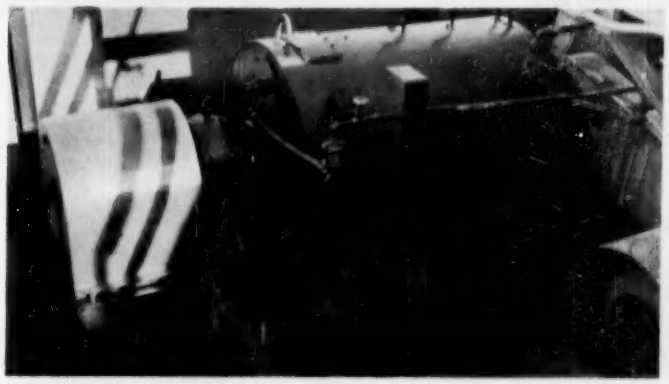
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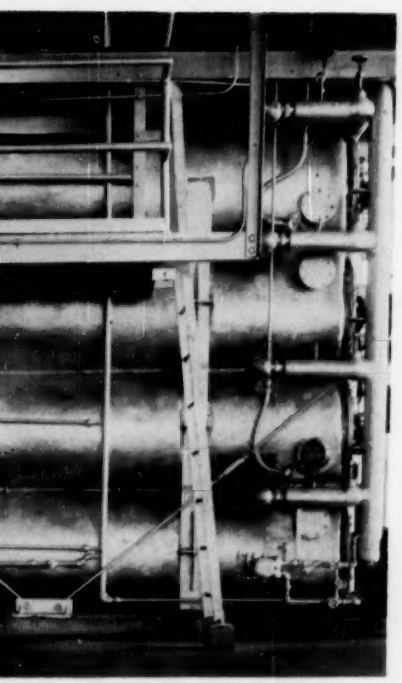
2 **MEAL STEAMER: Spent gluten f alcohol by direct steam (60 psi.) in**



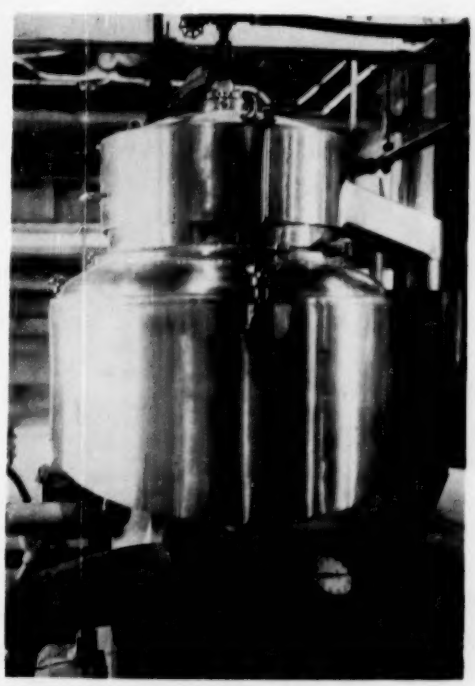




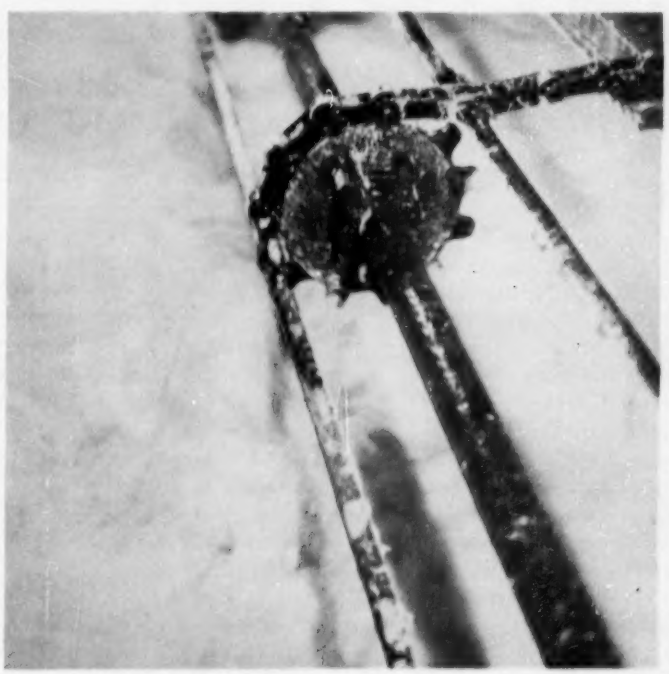
NEW EXTRACTION STAGE: Cocurrent alcohol, gluten overflow down 4, 400-gal. tanks, separate in solid bowl centrifuge.



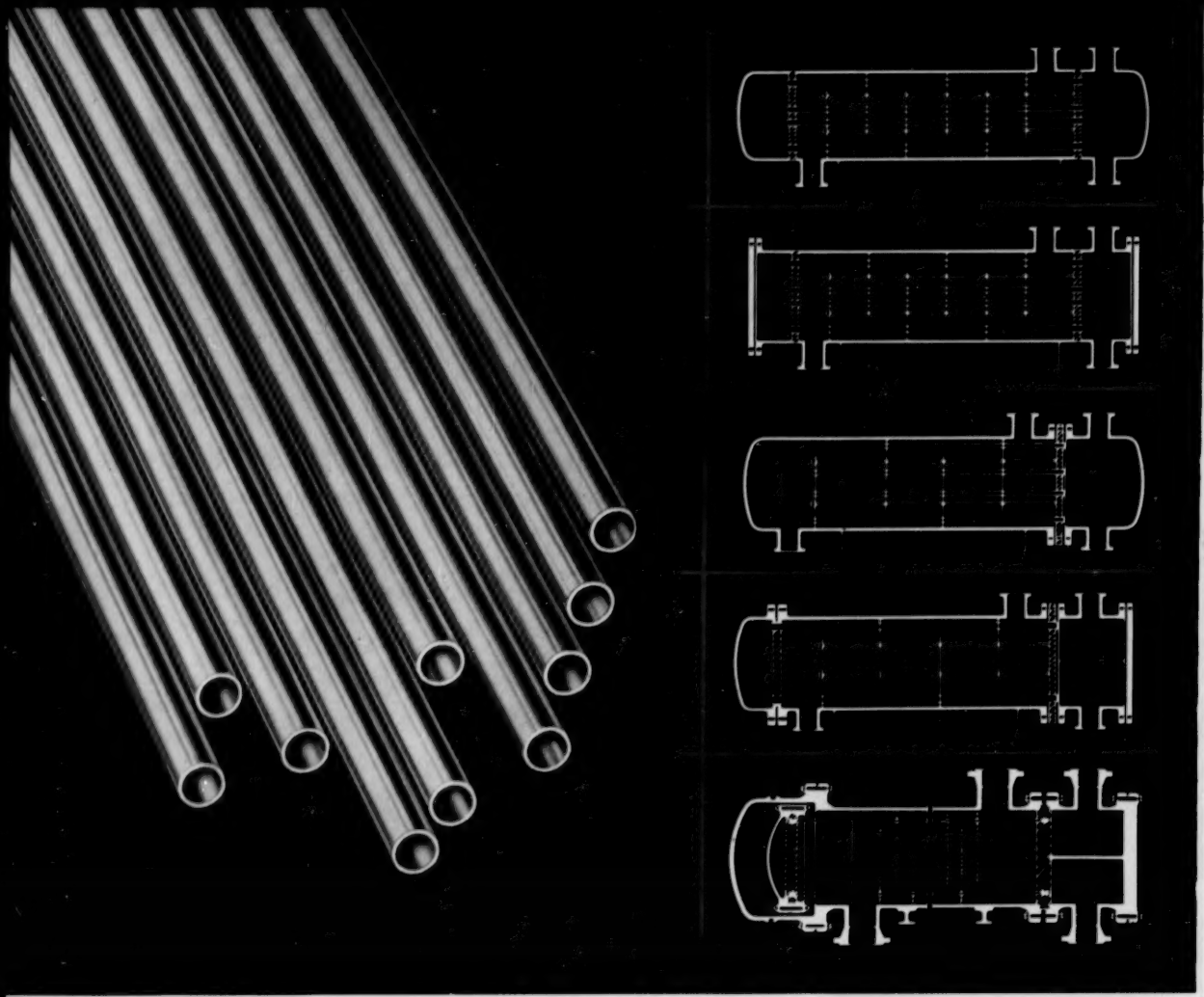
luten from centrifuge is steamed free of psi.) injection in jacketed screw conveyor.



CLARIFIER CENTRIFUGE: Here insolubles separate from cooled zein extract.



PRECIPITATION TANK: Clear alcohol-zein extract is injected in chilled (50 F.), turbulent water, zein fibers precipitate.



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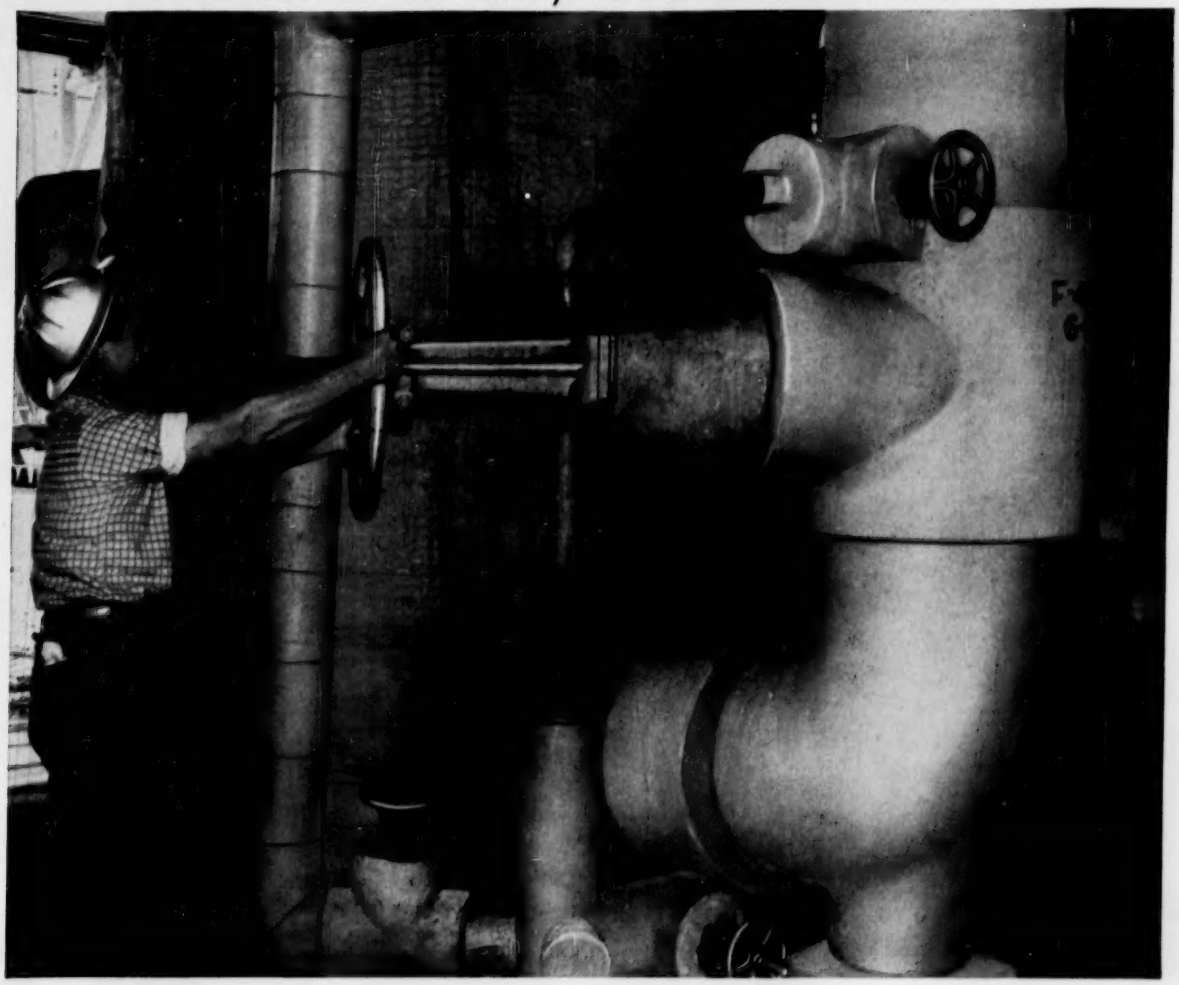
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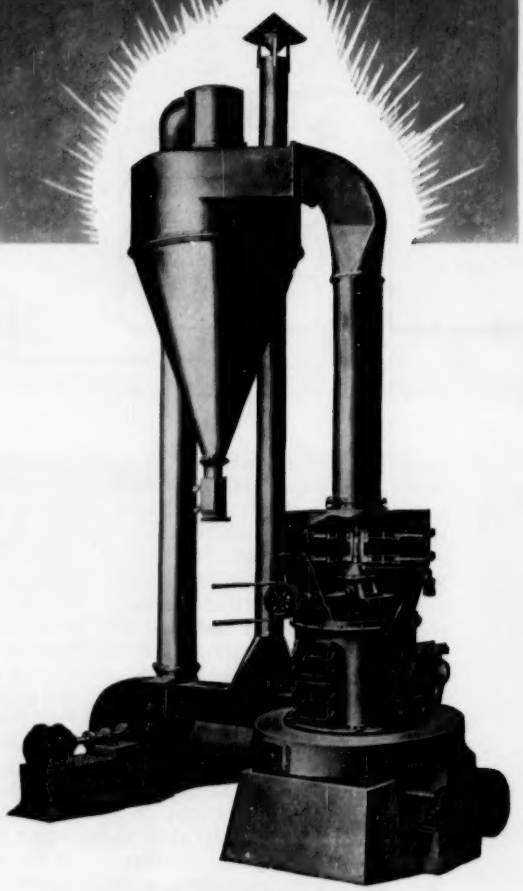
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This process yields high-grade zein . . . . . TURN BACK TO P. **226**

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A new processing tool **235**

It's time for chemical engineers to get to know ionizing radiations and their growing applications in processing.

Try this system for belt conveyor cost **242**

Devised by careful analysis of various belt conveyors and components; it allows for changing economic times.

On flow through packings and beds **245**

This installment presents working correlations and their applications to flow in fixed bed reactor systems.

Study this flowsheet of a flowsheet **249**

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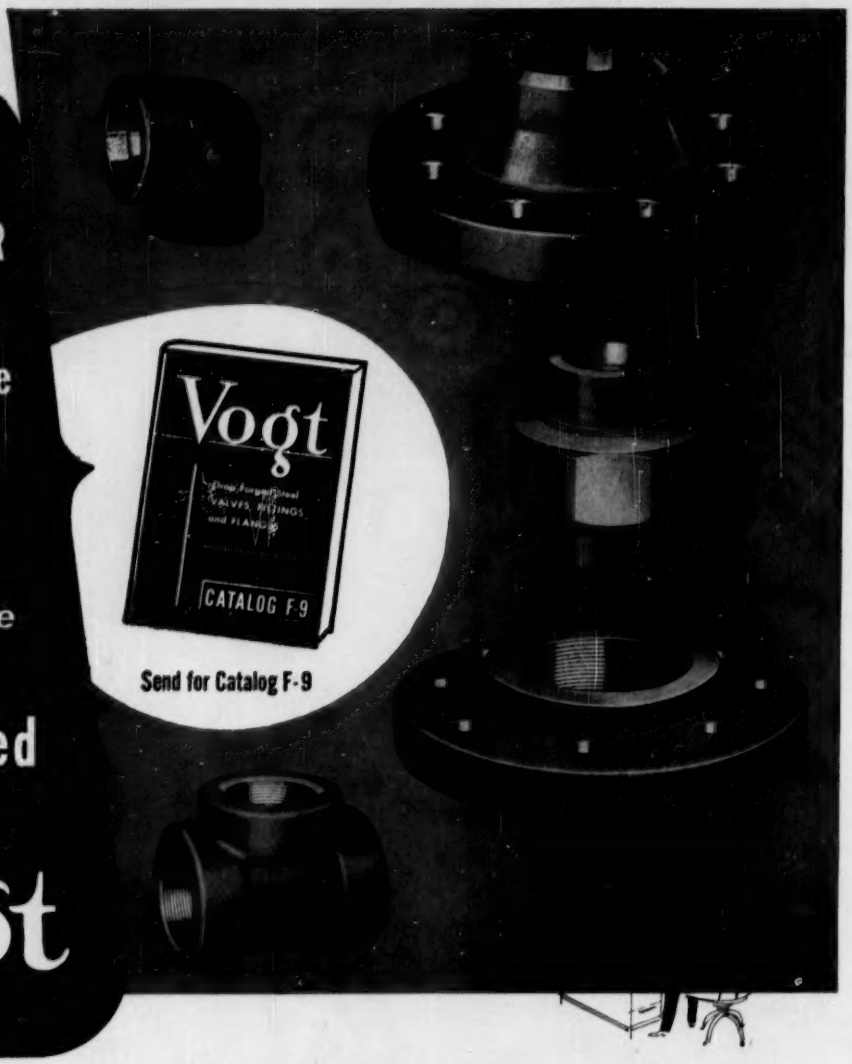
SEPTEMBER 1957

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Chemical Engineering
SEPTEMBER 1957



Ionizing Radiations

A NEW CHEMICAL ENGINEERING TOOL

High-speed electrons and other ionizing radiations are now in the processing picture. Here is a quick run-down on their position today, their production, use and economics.

E. ALFRED BURRILL, High Voltage Engineering Corp., Burlington, Mass. *

FOR many years physicists and chemists in university and industrial research laboratories have been investigating the effects of x-rays, gamma rays and high-speed electrons on chemical and biological systems. They have found applications, a few of which have already been commercialized. Interest in other potential applications is growing rapidly and the prospects for ionizing radiations as a processing tool are now such that it is time for chemical engineers to become acquainted with the terms, the equipment and the types of application of this new field.

As the interest in processing with ionizing radiations has grown, so have the methods for producing the radiations developed. Today, very intense sources of ionizing radiatons are commercially available. These, in turn, have opened up new research opportunities, while the research results have catalyzed industrial interest. On this account the chemical engineer is now beginning to come into the picture, so that he may extrapolate the accomplishments of research and apply it, along with today's industrial equipment, to the plant needs of tomorrow.

Why Radiation Processing?

When certain types of radiations are applied to materials they penetrate more or less completely and give up their energy to the material, mainly by stripping electrons from the molecules and thereby ionizing the molecules. There is also some production of free radicals and some evolution of heat. Since the molecular fragments thus formed tend to be very reactive, radiation supplies a new method of chemical processing and sometimes can bring about reactions that otherwise might not proceed at all. In other cases, radiation can be substituted for catalysis, or for more severe processing conditions of heat and pressure.

There is an extensive research literature on the effects of ionizing radiations on a wide variety of materials. This article will therefore merely summarize a few of the directions in which the commercial application of radiation processing appears to lie. Already the problems of such processing are approaching a practical solution in certain applications in petroleum, food, drug, plastics, packaging and chemical industries. In some areas the processes are already used on marketable products. In others much painstaking investigation lies ahead and commercialization can be considered promising only on a long-term basis.

The first promising developments are found in the drug and pharmaceutical industry where interest centers on the sterilization of drugs and surgical supplies, including antibiotics, sutures, medical supplies, sterile containers, human tissues and bone. Upjohn Co. has been turning out electron-sterilized opthalmic ointments, and Clay-Adams Co., surgical tubing.

* Meet your author on page 340.

The second area of present industrial application is in the crosslinking of plastic polymers. Not all polymers crosslink under radiation; in fact, many show noticeable degradation even under relatively low dosage. However, polyethylene is one polymer which lends itself especially well to radiation processing, undergoing improvement in certain physical properties when irradiated. Tensile strength and solvent resistance are somewhat increased while softening point is notably raised. These effects are particularly useful in electrical insulation.

As a consequence, Sequoia Process Co. is irradiating electrical cable, while General Electric Co. is treating polyethylene tapes. Others are seriously considering the use of similar processing. There are other possibilities in the plastics field, including the so-called graft polymerization. Also, the rubber industry is interested in the fact that uncured rubber can be vulcanized in seconds, without heat or sulfur, through ionizing radiation. Practical application of the process is limited at present by technical and economic factors.

Chemical and petroleum industries have an extremely active research interest at present in radiation processing, although applications have not reached the commercial stage. Radiation can initiate such reactions as polymerization, halogenation, oxidation and hydrogenation. Elimination of catalysts and the possibilities for conducting reactions under different conditions of temperature and pressure are the principal reasons behind this interest.

One of the outstanding potentials for radiation processing lies in food preservation, either to extend shelf life or to give long-time protection against spoilage. Exhaustive studies are now being conducted by the U. S. Quartermaster Corps. Others are investigating the effects of radiation processing on virtually every item of nourishment. It has been established that food can be preserved for prolonged periods, often without refrigeration. However, massive radiation doses tend to affect flavor and other properties of many foods and much present effort is aimed at finding ways to prevent such undesirable effects. Low-dose applications designed to increase storage life or to prevent insect reproduction are more encouraging at present and the economics appears more favorable.

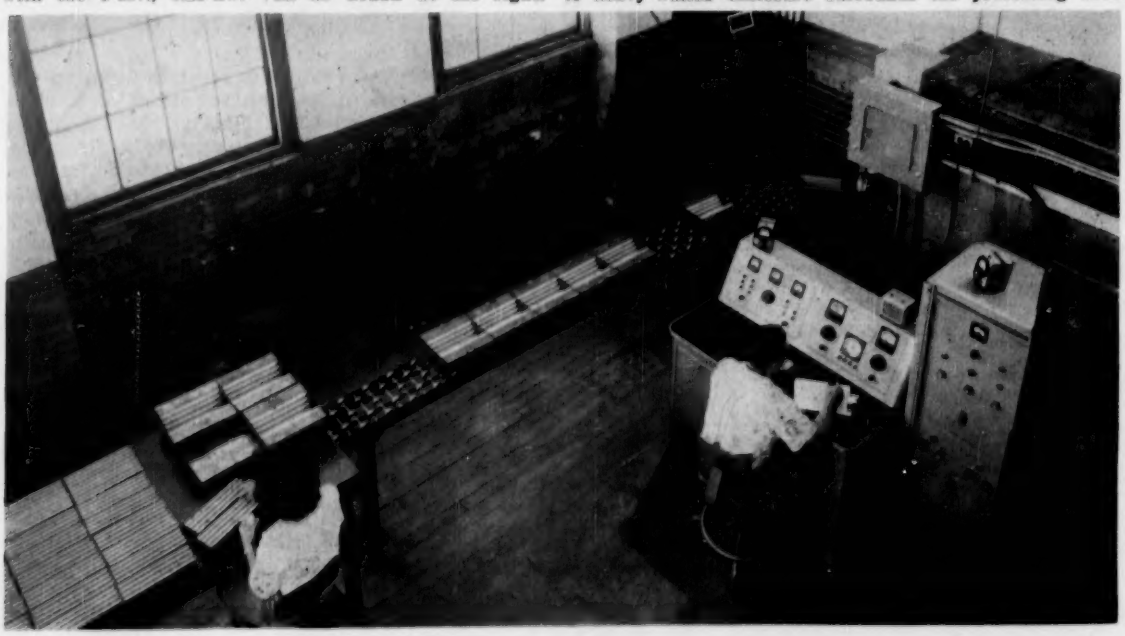
There are, of course, many other processes which are being explored, but which cannot be disclosed for proprietary reasons. As reductions in processing cost become available through the development of lower cost industrial radiation sources of adequate ionizing power, more and more applications will become commercially practical.

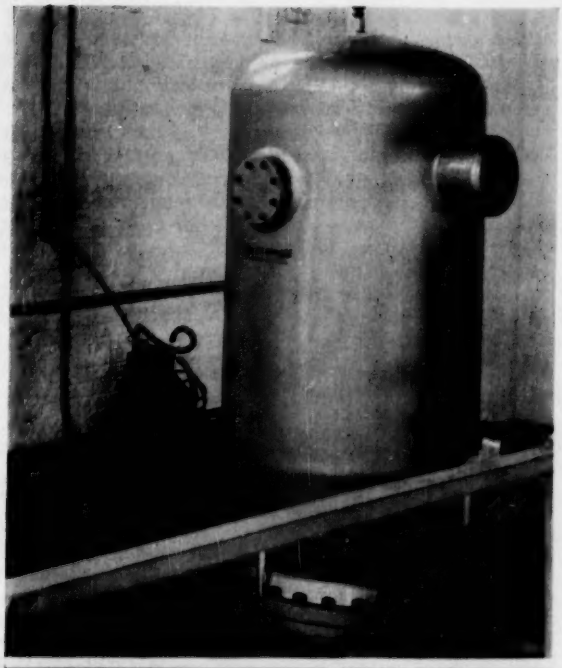
Radiation and Its Sources

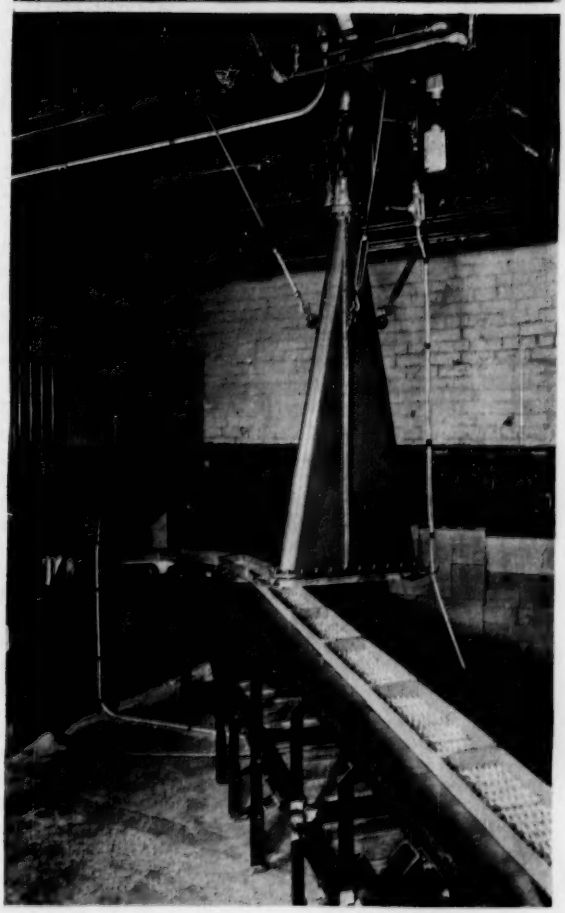
Although the physicist is concerned with a wide variety of particles and radiations including protons, deutrons, alpha particles, neutrons, beta particles, x- and gamma rays, and high-speed electrons, only the last two, gamma rays and high-speed electrons, are of value in the field of radiation processing we are discussing here.

The effects of gamma rays and high-speed electrons on matter are substantially the same, although their propagations through matter are somewhat different. Gamma rays and x-rays are very similar. For our purposes here it will be sufficient to distinguish between them on the basis of source. X-rays are "bundles" of energy (photons) produced when a suitable target is bombarded by a stream of high-speed

Typical production line for radiation processing of surgical supplies. Below is the feed conveyor and operating console, with the 1-Mv., 0.25-kw. Van de Graaff at the right. A heavy-walled enclosure surrounds the processing area.







electrons. Gamma rays are similar photons produced by certain nuclear disintegrations. The principal present gamma ray sources are cobalt-60 and cesium-137. The first is produced by neutron activation of cobalt metal in a nuclear reactor. Cesium-137 is produced by the separation of fission products.

Other potential sources of gamma radiation lie in mixed fission products from the reprocessing of spent nuclear fuels; in spent fuel elements before reprocessing; and in nuclear reactors themselves. The various gamma sources are obtainable direct from the U. S. Atomic Energy Commission, or from a number of commercial organizations engaged in packaging radioactivity for practical use. Eventually, of course, commercial reactors will be available, and it is conceivable that radiation processing might be conducted as a byproduct of heat and power production.

High-speed electrons are produced by means of various types of particle accelerators or "atom smashers." Particle accelerators are also used by the physicist in accelerating other elementary particles such as protons, and alphas but in general these machines—the cyclotrons, synchrotrons and betatrons—are not only extremely large and expensive, but would be impractical for producing industrial-type radiations. Machines such as the Van de Graaff, resonant transformer and linear accelerator are the ones particularly suited to industrial use.

Any particle accelerator works on the basis that charged particles in an evacuated space can be accelerated by a suitable electric field. Any particle accelerator must include the following:

1. An evacuated tube or chamber in which the charged particles experience their acceleration.
2. A source of charged particles.
3. A means of generating an electric field with which to accelerate the particles.
4. (Certain types of accelerator only). A means of generating a magnetic field to contain the charged particles within a reasonable area.
5. A window in the evacuated space to permit the accelerated particles to emerge into the atmosphere; or a target to convert the energy of the accelerated particles to x-rays.

X-Ray Machine—The x-ray machine is the simplest particle accelerator. It is used for radiography, radiographic diagnosis and therapy. A high voltage from a transformer system is impressed across a cathode and anode (target) in an evacuated tube. The electrons from the heated cathode are accelerated by the high-voltage electric field in the tube and strike the target, their energy being converted very inefficiently to x-radiation. In lower-voltage machines the conversion efficiency is a fraction of a percent, and only a few percent in even the highest voltage x-ray machines. X-rays are therefore not used for radiation applications requiring large amounts of power.

Resonant Transformer—This machine is similar in principle to the x-ray machine but operates at higher voltages. Voltages in the range of 1 to 4 Mv. (million volts) can be obtained by coupling the inductance of the transformer to the capacitance of the grounded shell surrounding it, so that a tuned circuit results. An alternating voltage is impressed across the evacuated tube, biased in such a way that only a portion of the voltage cycle is used to accelerate the electrons. The shell is actually a pressure housing and contains

an electrically insulating gas to keep the accelerator dimensions to a practical minimum. Like the Van de Graaff accelerator next to be described, the resonant transformer can be used to produce either high-speed electrons for processing or—by bombarding a heavy metal target—x-rays.

Van de Graaff Accelerator—Instead of a transformer, the Van de Graaff uses an electrostatic system to generate a high voltage which is then impressed across an evacuated tube. A rapidly moving insulating belt continuously carries an electric charge from ground to high potential, similar to continuous charging of a condenser. Extremely high voltages—in the 1 to 6 Mv. range—are thus obtainable. A pressurized housing surrounds this machine to contain the electrically insulating gas as in the case of the resonant transformer. Also, as with the other machines described, electrons are given off by the heated cathode. These are accelerated down the length of a long glass and metal evacuated tube by the drop from the high voltage to ground potential.

The resulting electron beam has a diameter of about 1 cm. and consists of electrons moving at speeds close to that of light. Customarily the beam passes through an electromagnetic scanning section which causes the beam to play back and forth over a width of several inches at frequencies of several hundred cycles per sec. The scanned beam then emerges through a thin metal window to the point of use.

Van de Graaffs are used for research purposes as positive-ion accelerators and, with negative operation, as electron accelerators and for high-voltage x-rays.

Microwave Linear Accelerator—Where the machines described above operate on high voltages, the linear accelerator uses a travelling electric field at much lower effective voltage, produced by radio-frequency radar waves carefully guided along the interior of an evacuated tube. The electrons from the heated cathode are accelerated by this travelling field in much the same way that a surfboard rider is accelerated by the waves on a beach. Very high electron energies are obtainable from a linacc, up to several hundred Mev. This machine's range for processing is considered most useful at 4 to 20 Mev., which gives it several times the practical energy limit of the Van de Graaff, as we shall see.

Orbital Accelerators—Machines previously mentioned accelerate particles in a single pass and in a straight line. In the various orbital accelerators the particles travel in a spiral or circular path, receiving one or more additional "kicks" with each revolution. They are held within their proper path by a magnetic field produced by extremely large magnets and are finally discharged to atmosphere only after many revolutions and the attainment of extremely high energies.

One of these machines is the betatron which is used to produce high-energy electrons and x-rays. A doughnut-shaped evacuated tube serves as the secondary of a transformer. The electrons travel several hundred thousand turns in this doughnut, thereby simulating the number of turns of the secondary. To keep the electrons in a stable orbit a magnetic field is impressed across the doughnut, the intensity of the field increasing with the electron energy. These machines can operate in the 5 to 100 Mev. range, but with low output power for processing work.

The cyclotron is typical of the large research-type accelerators which are used for accelerating positively charged ions, rather than electrons. A magnetic field is used to keep the ions contained in an evacuated region. As the ions travel they pass through an accelerating electric field twice during each revolution, thereby attaining higher energy. The ion beam spirals out toward the periphery of the constant magnetic field as its energy increases. Cyclotrons operate in the 5 to 300 Mev. range. Because of the danger of induced radioactivity they are seldom used for processing work. Modifications of the cyclotron principle are able to produce particle energies up to several billion electron volts.

Energy and Power

It is easy for the chemical engineer to become confused among the various units employed in connection with ionizing radiations. The unit of energy is the electron-volt which is actually a kinetic energy term, not a potential. An electron under the influence of an electric field of 1 volt is accelerated to an energy of 1 electron-volt (abbreviated 1 ev.), which is equivalent to 1.6×10^{-12} ergs. The common unit is 1 million electron-volts, abbreviated 1 Mev.

The literature on ionizing radiation and its application tends to become confusing in referring more or less interchangeably to Mv.—which is a potential of 1 million volts—and Mev., an energy term as we have seen. The energy of electrons from various types of accelerator is often mistakenly referred to as so many Mv., whereas this term applies only to the accelerating potential, not the resulting energy.

The energy of gamma rays is often described in similar terms but the designation may be loosely used and incorrect. The main cause of confusion arises between the energy of gamma radiation, and its amount, the latter expressed in curies. A gamma results from a nuclear disintegration and is part of the excess energy involved in the process. The curie is a unit which expresses the number of nuclear disintegrations taking place in a second. Unless the energy of the gamma radiation is also indicated, the curie has no meaning in ionizing power discussions.

Although gammas and x-rays are similar, the energy content of x-rays introduces a further complication. Where the gamma rays from a particular radioactive isotope will have one discrete energy, x-rays can have any energy from zero to a maximum corresponding to the electron energy that created them on the target. The x-ray beam from a 1-Mev. electron accelerator is not therefore a 1-Mev. beam. Rather, its energy is contained in a continuous spectrum from 1 Mev. to zero, with a peak intensity of about 0.5 Mev.

Power of a beam of ionizing radiation is expressed rather similarly to power in an electric circuit, in terms of kilowatts of ionizing power. This term is the product of the energy of the electron beam, expressed in Mev., and the average electron current, expressed in milliamperes. The electron current is a measure of the number of electrons passing in the beam in a unit of time.

In the case of gamma radiation, power similarly is the product of the number of gamma-producing disintegrations per second (1 curie = 3.7×10^{10} distintegrations/sec.), times the gamma-ray energy, ex-

pressed in Mev. An approximate conversion of gamma power to electron power terms is that 1 kw. of electrons is equivalent to about 70,000 curies of gamma radioactivity, based on the ionizing characteristics of cobalt-60. It should be noted that the energy of gamma rays depends on the kind of isotope which produced them. For example, the energy of gammas from cobalt-60 is greater than that from cesium-137, although the half lives are in the opposite order.

Penetration

The penetration of ionizing radiation into material is directly proportional to the energy of the electron or ray, and inversely proportional to the density of the material. High-speed electrons have a definite range of penetration which is about 0.5 gm./(cm.^{2}) (Mev.). This apparently unusual method of expressing penetration is actually convenient and logical, since it is independent of the density. It means that an electron of 1 Mev. energy will penetrate about 0.5 cm. into a 1-cm.^{2} column of material of density = 1.0. Thus a 5-Mev. electron will penetrate about 1 in. into water, and half as far into material of density = 2.0.

Gamma rays differ from electrons in their penetration in that they do not have a finite range in matter, but attenuate exponentially. For comparison with electrons the so-called half-value thickness of gamma rays is a useful figure of merit. This means the thickness of material of unit density in which the gamma ray beam will be attenuated to half its original intensity. For example, a 1-Mev. beam of gammas will be 50% attenuated in passing through about 10 gm./cm.^{2} of matter, i.e., a 10-cm. column of water.

Sources and Energies

As we have seen, the principal types of electron accelerators used industrially are the resonant transformer, Van de Graaff, and linear accelerator. The resonant transformer is made in the 1 to 3½ Mev. range by General Electric Co. at Milwaukee, Wis. High Voltage Engineering Corp., at Burlington, Mass., builds the Van de Graaff in 1 to 3 Mev. energies for industrial use, although larger machines, to 10 Mev., have been made for research. Microwave linear accelerators are supplied in the 4 to 20 Mev. range by three makers, including Applied Radiation Corp., Walnut Creek, Calif.; High Voltage Engineering Corp., Burlington, Mass.; and Varian Associates, Palo Alto, Calif. Also, several are made outside the U. S.

Gamma ray sources, as mentioned, can be provided by the AEC and a few commercial suppliers. Most available sources are in the 1 to 10 kilocurie range and are used primarily for research. It is generally considered that the 0.5 to 1.3-Mev. energy range is most useful for radiation processing. Larger sources have been considered but are not generally available.

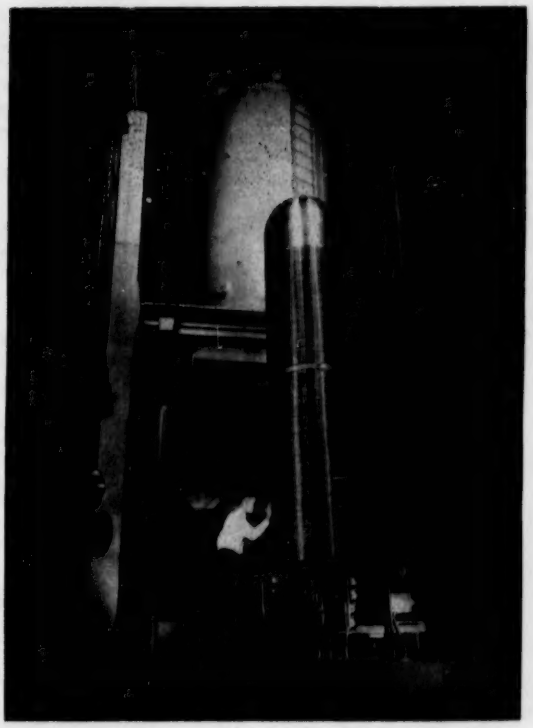
Radiation Source Limitations

Several factors applying to ionizing radiations must be considered in planning a processing application:

1. All sources produce radiations which are hazardous to personnel. Protective shielding must therefore be provided around radiation areas. The extent of shielding increases with the energy of the high-speed electrons or gamma rays being produced. Machine-produced radiation has an advantage compared with nuclear radiations in that it ceases when the machine is shut down.

2. Electron energies above 10 Mev. tend to produce neutrons which, in turn, can produce radioactivity in the air or in the product. Most of these radioactivities are short-lived, but their temporary existence must be taken into consideration.

3. Since radioactive isotope sources cannot be shut down like a machine radiation producer, they must be contained permanently in well-shielded housings with protective shutters; or they must be removable to ad-



Prominent Member of a Growing Family

Van de Graaff accelerator is one of the three types of accelerator most often considered for industrial use in production of ionizing radiations. Like the resonant transformer it uses high voltages, 1 Mv. or more, to accelerate electrons to velocities near that of light. Linear accelerators, on the other hand, use a travelling electric field of much lower voltage to accelerate electron pulses to still higher velocity (energy) levels.

In the Van de Graaff electric charges are carried by an insulating belt to a high-voltage terminal which is thus charged to high voltage like a condenser in a static machine. Electrons from a heated filament are then discharged down a long evacuated tube by the potential drop from the high-voltage terminal to ground. The high-energy electrons are fanned out by an electromagnetic scanning field for passage to the atmosphere through a thin aluminum window.

jacent protective areas when the processing line requires servicing.

4. Some applications are likely to require very high ionizing outputs, in the order of tens or hundreds of kilowatts from a single source. Other applications will be able to use several units of relatively low output. Available sources today fall in the latter category.

Dosage in Processing

In any particular processing application it is necessary to chose an accelerator or radioactive isotope source which will produce particles of sufficient energy to give the required penetration. On top of this, the required dosage must be supplied for each pound processed per hour. Dosage is a more complex subject than penetration. To understand it we must first understand the units in which radiation dose is measured. The most satisfactory basis for a system of measurement is the amount of ionizing radiation absorbed per unit weight of material. The unit now most generally accepted is the rad, which equals an energy absorption of 100 ergs/gm. A million rad units, called a megarad, equals 10 watt-sec./gm., or 4.5 kilowatt-sec./lb.

Unfortunately, the available literature discusses results in terms of several other radiation dosage units which should be mentioned to clarify the situation. The original unit of dosage was the roentgen, equal to 1 electrostatic unit of charge per cc. of air at NTP. For radiations other than x- and gamma rays the rep_{air} (i.e., the roentgen-equivalent-physical unit) was adopted, equal to 83 ergs/cm. Another unit, the rep_{tis}, is similar to rep_{air} except in magnitude and is equal to 93 ergs/gm. Finally, the newest unit, the rad, equals 100 ergs/gm., as noted.

Dosage requirements vary widely with the application and must be established for each individual type of product. A few typical dose ranges are:

	Megarads	Kw.-Sec./Lb.
Deinfestation of grains and cereal products	0.03— 0.08	0.135— 0.36
Food preservation	0.10— 0.50	0.45 — 2.25
Food, drug, medical supply sterilization	1.0 — 5.0	4.5 — 22.5
Crosslinking of polymers	10.0 —100.0	45.0 —450.0

The dosage range for inducing chemical reactions cannot be tabulated as simply because of the many factors which enter into establishment of the correct dose. Among them are the reaction type, the phase of the reactants, the temperature or pressure of the environment, and the dose rate. For example, dose rate may be important, as in catalytic reactions where the reaction proceeds more efficiently at low dosage rates. With higher dosage rates the ionizing power tends to become less effective, which affects the manner in which the product is introduced to the radiation and also governs the choice of radiation source.

Lack of information on the factors governing dose requirements has caused many companies to invest in research facilities involving either a particle accelerator or a radioactive isotope source. However, other concerns are using ionizing radiation facilities which are available on a rental basis. A few of the latter are listed:

Electrons at 2 Mev., 0.5 kw.: High Voltage Engineering Corp., Burlington, Mass., Van de Graaff accelerator.
Electrons at 1 Mev., 1.0 kw.: General Electric Co., Milwaukee, Wis., resonant transformer.
Electrons at 10 Mev., 4 kw.: Applied Radiation Corp., Walnut Creek, Calif., linear accelerator.
Cobalt-60 sources in 1 to 10 kilocurie range: Battelle Memorial Institute, Columbus, Ohio; Brookhaven National Laboratory, Upton, L. I., N. Y.; Budd Co., Nuclear Systems Div., Philadelphia, Pa.; Radiation Applications, Inc., Long Island City, N. Y.; Stanford Research Institute, Stanford, Calif.; University of Michigan, Ann Arbor, Mich.; Atomic Energy Co. of Canada, Ltd., Chalk River, Ont., Canada.

Processing Considerations

In considering the choice of an ionizing radiation source it must be recognized that the electron accelerators can produce far more ionizing power per unit machine than the currently available sources of gamma rays. Machines are therefore predominantly the choice for processing. However, gamma rays have relatively greater penetration into matter, which may be an important characteristic in the irradiation of bulky or thick products such as canned foods, sides of beef and thick plastic shapes. The electron accelerator, on the other hand, is much better suited for irradiating gas-phase reactions, thin films, slim packages, glass vials, and similar products.

Penetration of electrons into matter can be increased both by using a higher electron energy and by irradiating the product from both sides either simultaneously or consecutively. Both-sides irradiation increases the effective penetration by more than a factor of two. For example, with double bombardment a 3-Mev. accelerator can become equivalent to a 7.2-Mev. machine working from side only. The internal distribution of the ionizing radiation is also more efficient by this technique.

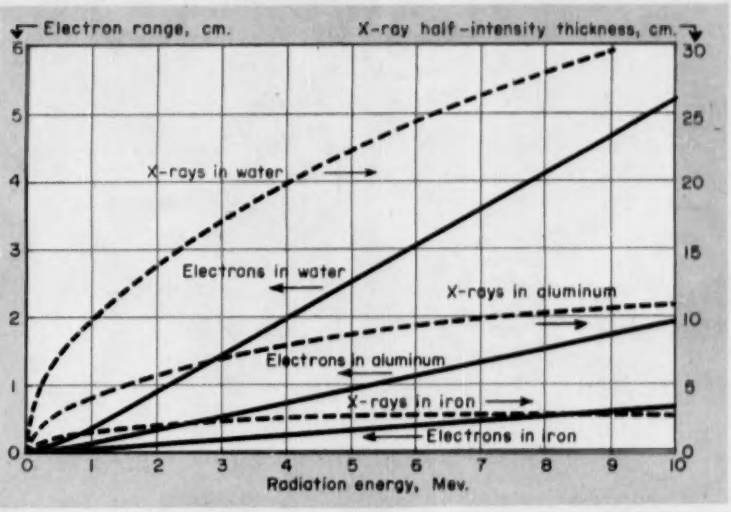
Solids of reasonably uniform cross sections can be passed through the electron beam twice, turning them over between passes. For liquid or solid products which might be disturbed by turning over, the electron beams of certain types of accelerator can be split and deflected magnetically for simultaneous bombardment of both sides.

We noted previously that the electron beam can be scanned and so can be spread laterally across the conveyor line, for irradiation up to 15-in. widths. Even wider scans are within the realm of practicality. It is also feasible to introduce electron radiations into pressure systems for gas-phase processing.

In estimating the energy and quantity of radiation required, the practical penetration for irradiation from one side can be considered as 0.33 gm./(cm.^{2}) (Mev.), with 0.5 gm./(cm.^{2}) (Mev.) as a maximum. With irradiation from both sides the penetration is about 0.8 gm./(cm.^{2}) (Mev.). As regards quantity of radiation, 1 kw. of ionizing radiation if fully utilized could deliver a dose of 1 megarad to about 800 lb./hr. of material. Except in selected cases the efficiency of use of ionizing radiation will not be 100%. As a first approximation about 50% is a satisfactory estimate. Thus, 1 kw. = 400 lb.-megarad/hr. at 50% efficiency. For a dose of 10 megarad, therefore, 1 kw. will treat 40 lb./hr. at this efficiency. If a 100,000-rad dose should be needed for food pasteurization, a 1-kw. accelerator would be able to treat 4,000 lb./hr.

The total ionizing power required is thus obtained by dividing the total process flow by the rate that can be handled by 1 kw. Whether a single accelerator should provide all the ionizing power needed, or whether several should split the load depends on the process as well as on the current state of accelerator

Extrapolated Electron Range and X-ray Half-Intensity Thickness in Water, Aluminum and Iron



Data on x-rays from W. S. Snyder and J. L. Powell, AECD-2739, 1949.
Data on electrons from L. E. Glendenin, *Nucleonics*, 2, 12, Jan. 1948.

development. Some processes lend themselves readily to the use of several accelerators, particularly where several production lines flow in parallel. The user's ability to adapt his production lines to the radiation-protection installations needed is a problem for the accelerator manufacturer's application engineer and the chemical engineer contemplating the process.

Electron accelerators available today for producing several kilowatts of ionizing energy in the range of several Mev. require 200 to 400 sq. ft. of floor space, and a 20 to 40 ft. height. Depending on the output power and electron energy, 2 to 5 ft. of concrete protective walls will be required in the area of radiation production. Careful design provisions for introducing the product into the radiation area are needed to avoid radiation hazard; ease of servicing and maintenance of conveyor lines which move through labyrinths or tunnels is an important consideration.

Quite probably future applications in some cases will demand very large accelerators pouring their ionizing energy into single process vessels. Such processes are ahead of current accelerator technology and the problems associated with such installations are still to be solved. Although the basis of design is now understood, the characteristics of the actual accelerator and its associated facilities are as yet unknown.

Radiation Economics

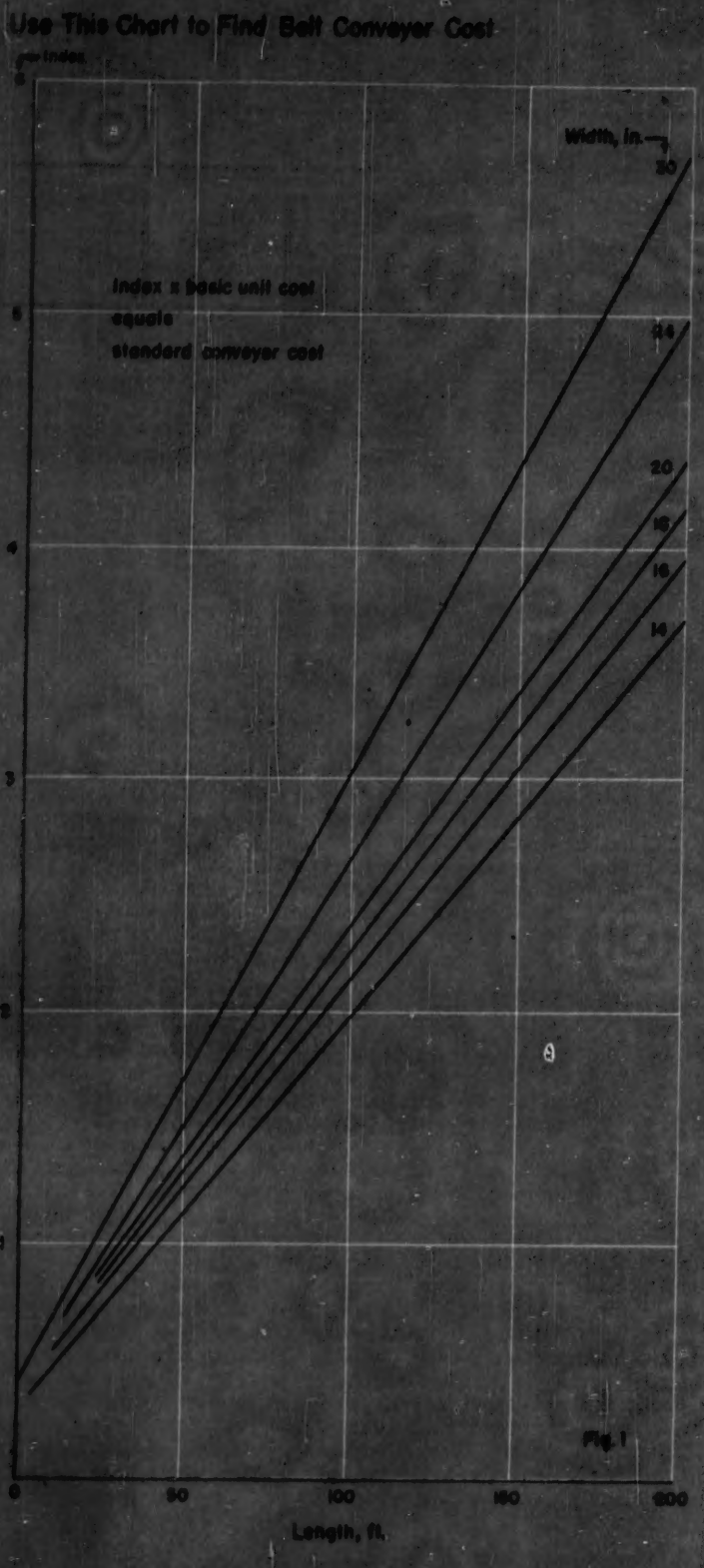
Owing to rapid progress in the technology of radiation source manufacture, the costs of radiation processing are continually changing. Equipment makers today are concentrating more on the requirements for longevity and low cost of operation than on the basis of radiation application. At present several electron accelerators are working on a production-line basis, producing ionizing radiations in the 1- to 4-kw. range for about $45,000/kw., not including protection and conveying equipment for the particular application. Processing costs on a 5-yr. amortization basis, including operator, power costs and normal maintenance are running about $0.01 per lb.-megarad.

Meanwhile, accelerator manufacturers are diligently at work to reduce costs further. Accelerator sources of radiation will become available in the range of $15,000 to $25,000/kw. in the near future. Processing costs per lb.-megarad will drop considerably, although not proportionately, since several of the fixed costs of a radiation facility will not be affected by reduction in equipment investment. With continuing improvement in technology and further demand for radiation sources, both capital and operating costs will inevitably decrease still further.

It is true that the cost of radiation facilities is less susceptible to reduction than the cost of accelerators, since building costs will reflect the usual trends. A facility for one of the accelerators available today comes to $5,000 to $50,000, depending on whether an existing building can accommodate the needed shielding, or a new structure must be provided specifically for housing the accelerator. Another $6,000 or so will be required for conveyor lines and accessories to handle products in the radiation area.

The situation with respect to gamma-ray sources is less clear-cut, because of many uncertainties in the supply of adequate radiation for industrial processing needs. Today's cost of cobalt-60 radioactivity is extremely high—several hundred thousand dollars per kilowatt-equivalent. With better methods of preparing isotopes these costs will probably decrease, although it is highly unlikely that the costs for radioactive sources will ever drop below those for electron accelerators on a per-kilowatt basis. Problems of radiation shielding and handling of the isotopes will always dominate the cost factor and these are not as amenable to cost reduction as the sources themselves.

At present we cannot foresee just what kinds of particle accelerators future radiation processing will demand. It is important therefore that the equipment manufacturer and the ultimate user approach this problem in a cooperative endeavor, enabling the manufacturer to keep abreast of research results and thus to adapt his equipment effectively. Conversely, the user must keep acquainted with the developments in sources, to the end that he can apply them to his processes at the most propitious time.



Use Index to

HERBERT E. MILLS,
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Belt conveyers for materials handling have been in use since the middle of the nineteenth century. From an originally simple form they have developed into a much more complex piece of equipment with great variations in design. These variations are determined by the use the conveyer will be put to, type and amount of material handled, distance the material is to be carried and space available.

To determine the cost of a belt conveyer when a manufacturer's quotation is not available, the usual case is to estimate an extremely rough price based on the cost/ft. Since every feature specified in a belt conveyer influences the total cost, this method is not very accurate.

To make cost estimating of a belt conveyer more exact, the following graphs and tables have been devised by careful analysis of various belt conveyers, their component parts, the cost of these parts and their relationship to each other and by careful study of the time required for installation.

These graphs and tables are set up so that any economic trend, higher or lower, can be compensated for by a simple adjustment.

First Get the Conveyer Cost

Cost relationships of the most commonly used standard belt conveyers are shown in Fig. 1.

Specifications for the standard belt conveyer are as follows: (1) Steel welded frame, no additional supports; (2) steel head and tail pulleys; (3) 5-in. dia. steel troughing and return idlers; (4) cold-rolled steel head and tail shafts; (5) roller bearings for head shaft; (6) screw take-up bearings for tail shaft; (7) 4-ply, 28-oz. duck belt, $\frac{3}{32}$-in. and $\frac{1}{8}$-in. rubber coverings; (8) to convey 50 lb./cu. ft. of material; (9) extended lubrication fittings.

The basic unit used is a 14-in.

* Meet your author on page 339.

Estimate Cost of Belt Conveyers

You can accurately estimate belt conveyer cost by graphs and tables. Changing economic conditions can be easily compensated for.

wide belt conveyer, 42 ft. long and estimated to cost $2,000 in April, 1957. In Fig. 1, this value of $2,000 becomes the basic unit cost and is set equal to an index of 1.00. Costs of all other standard belt conveyers within the limits of this chart can be obtained by their relationship to this point; i.e. standard cost = index × basic unit cost. In estimating belt conveyers of widths not shown, Fig. 1 can act as a guide.

Should prices increase or decrease over a period of time because of economic trends, this chart can still be used by simply adjusting the basic unit cost.

The following example illustrates the use of this graph.

Problem 1—Estimate the cost of a 24-in. wide, 60-ft. long belt conveyer of standard specifications.

Solution—Locate the index for a standard 24-in. wide belt conveyer, 60 ft. long on Fig. 1. This is found to be 1.70. Multiply the index by the basic unit cost of $2,000 to get the cost for a stand-

Cost of Drives

(Speed-reducer, chain, sprockets and guard)

Horsepower	Percent of Basic Unit Cost
1	22
1.5	24
2	28
3	31
5	40
7.5	52
10	61
15	70
20	82
25	94

Weight for Freight Costs

Standard Belt Conveyers

Width, In.	Lb./Ft.
14	60
16	65
18	70
20	80
24	90
30	100

Drives

Horsepower	Weight, Lb.
1	240
1.5	270
2	270
3	360
5	410
7.5	620
10	730
15	1,030
20	1,320
25	1,350

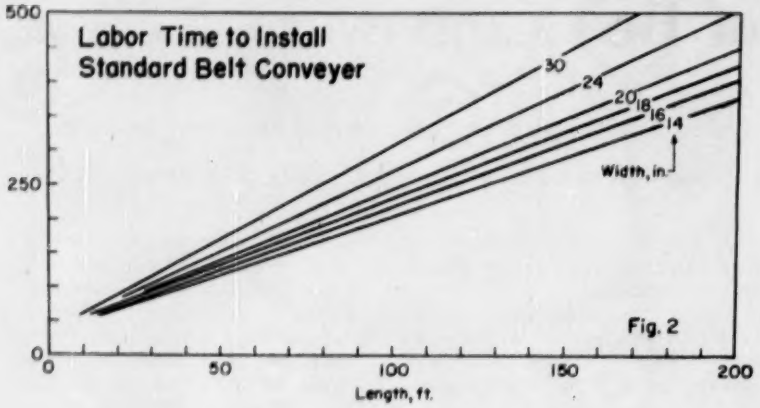
Cost of Additional Components

. . . In Terms of % of Standard Cost

	Belt Width, In.					
	14	16	18	20	24	30
75-lb./cu. ft. material	1	1	2	2	2	3
100-lb./cu. ft. material	1	2	2	3	3	3
150-lb./cu. ft. material	3	4	4	5	5	6
Steel troughing idlers, 6-in. dia	3	3	3	2	2	2
Steel return idlers, 6-in. dia	1	1	1	1	1	1
Rubber-covered spiral return idlers, 5.5-in. dia.	3	3	3	3	3	3
5-ply, 32-oz. duck belt, 1/8-in. and 1/32-in. rubber covers	7	8	8	8	9	9
6-ply, 36-oz. duck belt, 1/8-in. and 1/32-in. rubber covers	14	15	15	16	16	18
Asbestos ply in belt	9	10	10	11	12	13
No. 16 gage deck plate for dust shield	8	9	9	9	9	9
Conveyer trippers	—	12	12	12	12	12
Belt enclosure, No. 14 ga. corrugated steel, asbestos coating	8	9	9	9	10	11

. . . In Terms of % of Basic Unit Cost

	Belt Width, In.					
	14	16	18	20	24	30
Snub pulleys, bare	9	10	10	10	11	12
Lagged pulleys	10	10	11	11	12	14
Lagged pulleys, snubbed	24	24	25	26	27	32
Ratchet wheel holdback	8	8	8	8	8	8
Loading chute and skirt boards	5	6	6	8	10	13
Discharge chute	5	5	6	7	7	9
Horizontal gravity take-ups	—	16	16	17	18	22
Vertical gravity take-ups	—	16	17	18	20	24
Conveyer trippers						
Friction automatic	—	130	131	137	140	176
Motor propelled	—	180	182	185	200	225
Magnetic head pulley, 20-in. dia	41	49	49	57	71	89
Low-speed rotary belt cleaner	16	17	18	18	20	22
Impact idlers under loading chute	—	—	—	17	17	18



ard belt conveyer made this size.

1.70 × $2,000 = $3,400

Then Estimate the Additions

From the tables presented we can estimate the cost of any additional parts and the approximate weight for freight costs. It should be noted that some parts are affected only by the width (function of the basic unit cost) while others are affected by the width and the length (function of the standard cost).

The following problems will illustrate the use of these tables in conjunction with Fig. 1.

Problem 2—Estimate the cost of a belt conveyer.

Specifications—Standard, except for the following:
24 in. wide, 100 ft. long
To convey 100 lb./cu. ft. of material
Loading chute and skirt boards
Discharge chute
5-hp. drive.

Solution—Locate the index for a standard 24-in. wide belt conveyer, 100 ft. long on Fig. 1. This is found to be 2.65. Multiply by the basic unit cost to get the cost of a standard belt conveyer of this size.

2.65 × $2,000 = $5,300

To convey 100 lb./cu. ft. of material:
0.03 × $5,300 = $159
Loading chute and skirt boards:
0.10 × $2,000 = $200
Discharge chute:
0.07 × $2,000 = $140
5-hp. drive:
0.40 × $2,000 = $800
Total cost = $6,599

Problem 3—Estimate the cost of a belt conveyer with specifications as follows:

Specifications—Standard, except:
16 in. wide, 150 ft. long
Magnetic head pulley, 20-in. dia.
Loading chute and skirt boards
Discharge chute
Snub pulley
5-hp. drive.

Solution—Locate the index for a standard belt conveyer, 16 in. wide, 150 ft. long on Fig. 1. This is found to be 3.05. Multiply by the basic unit cost to get the standard cost.

3.05 × $2,000 = $6,100

Magnetic head pulley, 20-in. dia.:
0.49 × $2,000 = $980
Loading chute and skirt boards:
0.06 × $2,000 = $120
Discharge chute:
0.05 × $2,000 = $100
Snub pulley:
0.10 × $2,000 = $200
5-hp. drive:
0.40 × $2,000 = $800
Total cost = $8,300

Problem 4—Estimate the cost of a belt conveyer with specifications as follows:

Specifications—Standard, except:
30 in. wide, 200 ft. long
5-ply, 32 oz. duck, rubber-covered belt
Deck plates
Motor propelled tripper
Loading chute and skirt boards
Snub pulley lagged
Ratchet wheel holdback
Impact idlers under loading chute
10-hp. drive.

Solution—On Fig. 1 locate the index for a standard belt conveyer 30 in. wide and 200 ft. long. This is found to be 5.70. Multiply by the basic unit cost for the standard cost.

5.70 × $2,000 = $11,400

5-ply, 32 oz. duck, rubber-covered belt:
0.09 × $11,400 = $1,026
Deck plate:
0.09 × $11,400 = $1,026
Motor propelled tripper:
0.12 × $11,400 = $1,368
Motor propelled tripper:
2.25 × $2,000 = $4,500
Loading chute and skirt boards:
0.13 × $2,000 = $260
Snub pulley lagged:
0.32 × $2,000 = $640
Ratchet wheel holdback:
0.08 × $2,000 = $160
Impact idlers:
0.18 × $2,000 = $360
10-hp. drive:
0.61 × $2,000 = $1,220
Total cost = $21,960

Now for the Labor Costs

Time required for the installation of standard belt conveyers is shown in Fig. 2. These hours represent the estimated time required to install belt conveyers under ideal conditions: outside installation in a clear area. By applying the following factors, the graph may be adjusted for other than ideal conditions: outside congested area = 0.20; inside clear area = 0.12; inside congested area = 0.35.

Engineering judgment should be applied to determine the time required for installation of items not listed as standard.

Problem 5—How long will it take to install a belt conveyer of standard specifications, 24 in. wide and 60 ft. long in an outside clear area?

Solution—Directly from Fig. 2, a 24-in. wide, 60-ft. long standard belt conveyer takes 175 hr. to install.

Problem 6—How many hr. is required to install a belt conveyer of standard specifications, 24 in. wide and 60 ft. long in an inside congested area?

Solution—Determine the time in hr. for a standard belt conveyer, 24 in. wide and 60 ft. long from Fig. 2. This is found to be 175 hr. Apply the factor for an inside congested area and add this to the standard time.

0.35 × 175 = 61 hr.

Total time = 61 + 175 = 236 hr.

FLOW THROUGH PACKINGS AND BEDS

Correlations in Fixed Bed Systems . . .

- How to predict pressure drop by means of a Kozeny-Carman type equation.
- How to handle pressure drop when compressible fluids flow through reactor beds.
- How step-by-step analysis enables calculation of power requirements for fluid circulation.

How the Series Is Organized

Random Packed Towers
Stacked Towers
Reactors
Fixed and Moving Beds
Equipment
Variables in the System
• Correlations
Fluidized Systems

MAX LEVA, Consulting Chemical Engineer, Pittsburgh, Pa. *

This installment presents working correlations and their applications to flow in fixed bed reactor systems. Earlier articles (Chem. Eng., July 1957, p. 258 and Aug. 1957, p. 263) discussed apparatus construction and operation and evaluation of system variables.

For predicting pressure drop in fixed beds of granules as well as spheres, cylinders, rings and other geometric shapes, the Kozeny-Carman type equation

$$\Delta p = \frac{2fG^2L(1-\epsilon)^{3-n}}{D_p\phi_s^{3-n}\epsilon^3 g_c\rho_F} \qquad (1)$$

may be used. In this form the equation applies virtually to the entire flow range as is characterized by the laminar, transition and turbulent regions.

In order to adapt the equation to any particular flow range, it is necessary to replace the state of flow factor n by its proper numerical value. As has been pointed out in an earlier article n is a function of the modified Reynolds number. Ordinarily in flow problems, the components of the modified Reynolds number are available. Hence the value of $N_{Re} = D_p G/\mu$ is readily evaluated. This will then lead to an evaluation of n. Particular n values are found as follows:

For Reynolds number less than ten, the flow is laminar and $n = 1.0$. For Reynolds number greater than 100, the flow tends to become increasingly more turbulent and n approaches 2.0 for entirely turbulent flow. However, for most applications where the Reynolds number is greater than 100, the state of flow factor may be taken as $n = 1.9$.

For the intermediate range, n varies with N_{Re} as follows:

N_{Re}	n
10	1.0
30	1.3
50	1.5
70	1.6
90	1.7

The modified friction factor f is a function of Reynolds number in a similar fashion. Thus for the laminar flow range, $f = 100\ (D_p G/\mu)^{-1.0}$. Substitution of this value of f and $n = 1.0$ into Eq. (1) yields

$$\Delta p = \frac{200G\mu L(1-\epsilon)^2}{D_p^2\phi_s^2\rho_F g_c\epsilon^3} \qquad (2)$$

This form of the equation has been found applicable with satisfactory results to a wide range of conditions that prevail in the fixed bed when the flow is laminar. It is also of interest to point out that the equation has been most useful for data evaluations that pertain to fluidized systems. This will be discussed in detail in a later article.

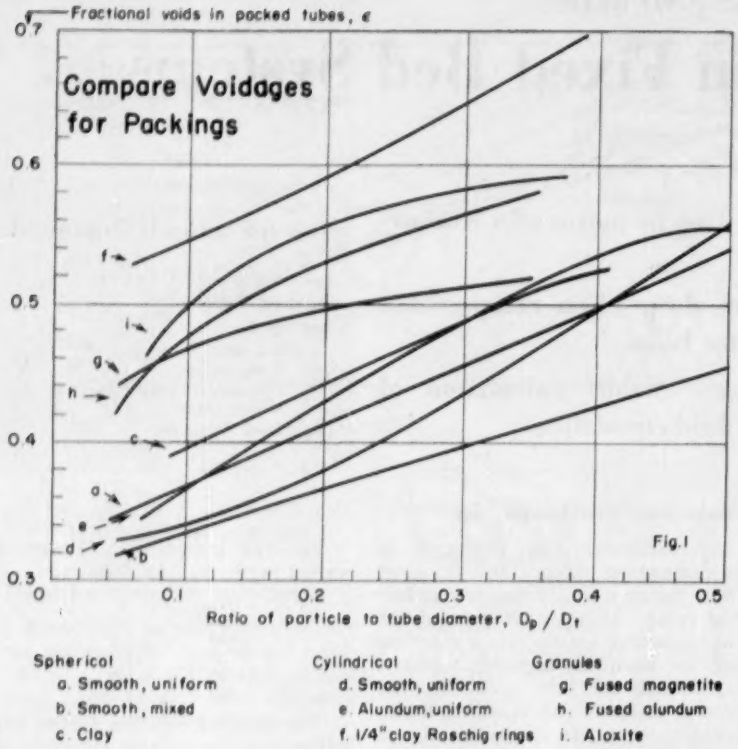
In order to properly apply the equation, the various quantities which compose it must be available. Mass flow rates, fluids viscosities and bed heights are usually available. Voidage data may be estimated for a range of particles and sizes from Fig. 1. For smaller particles, such as are usually employed in fluidization the correlations of Fig. 1 are not suitable. Resort must then be taken to other data which will be presented in a later article. The equation also applies to beds that are composed of a mixture of sizes.

For mixtures where the size range is no more than two-fold, it

* For author biography see *Chem. Eng.*, July 1957, p. 316.

Nomenclature (Consistent Units)

A	Total surface area of a single particle	d_p	Size of any one component in a mixture
D_p	Particle diameter	f	Modified friction factor
G	Fluid mass velocity	f_m	Modified friction factor (Happel)
L	Packed height	g_c	Conversion factor
M	Molecular weight	m	Number of components of sizes in a mixture
N_{Re}	Modified Reynolds number		
P	System pressure	n	State of flow factor
R	Gas constant	v	Specific volume of fluid
T	Absolute temperature	α	Mechanical efficiency of motor-blower combination
V	Volumetric flow rate		
V_p	Total displacement volume of a single particle	Δ_p	Pressure drop
		ϵ	Bed voidage
X	Weight factor of any one component in a mixture	μ	Fluid viscosity
		ρ_F	Fluid density
Z	Compressibility factor	ϕ_s	Bed shape factor



is satisfactory to calculate average size by

$$D_p = \sum_{m=m}^{m=1} x_m d_p \qquad (3)$$

If the mixture is more complex, the average size may be calculated by

$$D_p = 1 \Big/ \sum_{m=m}^{m=1} (x_m/d_p) \qquad (4)$$

In these equations X is the weight fraction of any one component; m is the number of the components in the mixture and d_p is the size of any one component. If the component is characterized by sieve ratings, then $d_p = (d_1 \times d_2)^{0.5}$ where d_1 and d_2 are adjacent sieve openings.

With respect to the limits of voidage and the voidage function, application of Eq. (2) to cases where $\epsilon = 0.80$ is not suggested. This is of little concern in the present discussion on fixed beds. Here values of ϵ are ordinarily below this value. However, the question becomes of interest in fluidized systems and the point is discussed in more detail in a later article.

The evaluation of shape factor has been discussed (*Chem. Eng.*, Aug. 1957, p. 263). For granular materials, the shape factor must be measured by flow experiments. If this is impractical, it may be approximated by comparison with bodies of known shapes.

For most geometric shapes

$$\phi_S = 4.90 V_p^{2/3}/A \qquad (5)$$

where V_p is the displacement volume and A the total surface area of a single particle.

Effect of Fluid Density

Probably in most applications where compressible fluids are involved, conditions and flows are such that the pressure drop of the fluid is small when compared to the upstream fluid pressure. Under such conditions the fluid density ρ_F may be considered essentially constant through the reactor. All calculations of pressure drop may be based on this given fluid density.

However, at times the pressure drop may become of the order of magnitude of the upstream pressure. Obviously for such a case the fluid density through the reactor is no longer constant.

To account for the change in fluid density, Eq. (1) has been properly differentiated[8]. The following equation is applicable to cases where substantial pressure drops are involved.

$$P_1^2 - P_2^2 = \frac{2ZRG^2T}{g_c M} \times \left[\ln \frac{v_2}{v_1} + \frac{2f(1-\epsilon)^{2-n}}{\phi_S{}^{(1-n)}\,\epsilon^3 D_p} L \right] \qquad (6)$$

Besides being dependent on the pressure and hence pressure drop of the compressible fluid, the fluid density will in practice also depend on temperature and composition changes of the fluid in the reactor. Obviously in this case, the temperature and conversion pattern of the reaction must be known. Also the behavior of these factors within the reactor must be known. A simple integrated form of pressure drop equation is not feasible.

If the variations in properties are sufficiently large that they must be accounted for in estimating pressure drop, a stepwise calculation procedure with subsequent graphical integration is the most practical approach.

Eq. (6) is used just like Eq. (1). Hence the state of flow factor is evaluated first and then the expression in the parenthesis. The procedure thereafter is straightforward, as will become apparent from a sample problem.

Considering application of Eq. (1) to the turbulent flow range, friction factors were found to be a function of Reynolds number and of the nature of the surface of the particles.

Thus for smooth particles such as glass, porcelain or celite, $f = 1.75/N_{Re}{}^{0.1}$; for rougher bodies, such as Alundum cylinders, $f = 2.63/N_{Re}{}^{0.1}$; and for still rougher particles such as Aloxite granules, $f = 4.0/N_{Re}{}^{0.1}$.

Substituting the expression $(C/N_{Re}{}^{0.1})$ for f and $n = 1.9$ into Eq. (1) yields:

$$\Delta p = C \frac{G^{1.9}\mu^{0.1}L(1-\epsilon)^{1.1}}{D_p{}^{1.1}\phi_S{}^{1.1}g_c\rho_F\epsilon^3} \qquad (7)$$

where constant C depends on the surface condition of the granules. Its value is suggested as follows:

Particle Surface	C
Glass- or porcelain-like	3.50
Alundum-like	5.25
Aloxite-like	8.0

The components for Eq. (7) are evaluated in the same way as those for Eq. (1). Limitations of applicability are also those of Eq. (1).

Pressure Drop in Moving Beds

For moving beds Eq. (1), (6) and (7) may be used with fair success provided the mass velocity of the gas is referred to the moving solids instead of the fixed wall. This will apply to both countercurrent as well as concurrent flow.

A special study of pressure drop through moving beds has been made by Happel.[1] He suggested that

$$\Delta p = \frac{2f_m G^2 L(1-\epsilon)^3}{D_p g_c \rho \epsilon^3} \qquad (8)$$

The modified friction factor f_m is a function of the modified Reynolds number $D_p G\ (1-\epsilon)/\mu$ as shown in Fig. 2. If the solid phase is composed of a range of sizes, Happel suggested that

$$D_p = \frac{1}{\Sigma X/D_p}$$

where X is the weight fraction of size D_p.

Eq. (8) is based on extensive data that were observed in columns ranging from 4 to 10 in. diameter. The experiments comprised concurrent as well as countercurrent flow of solids and air. Solids chosen were uniform as well as mixtures of catalysts ranging in size from 4 to 60 mesh. Solids feed rates ranged from zero to more than 2,000 lb./sq. ft.-hr. for the smallest particles.

Power Requirements

An important consideration in fixed bed design involves the estimation of the power requirement for fluid circulation. This is obviously required so that estimated may be arrived at regarding blower type and size.

The power requirement is simply obtained by applying the expression

$$HP = \frac{\Delta p \times V}{33{,}000 \times a} \qquad (9)$$

where Δp is the pressure drop, lb./sq. ft.; V is the volumetric fluid flow rate, cfm. and a is the mechanical efficiency of the motor-blower combination. This will vary for specific installations, but may be assumed to be equal to about 0.5 for many cases.

Estimation of required pumping horsepower is made rapidly if the pressure drops are modest. If on the other hand the pressure drops are significant, the fluid-density changes through the equipment will become large. A step by step calculation procedure may then be required. This is amply illustrated by the following practical problems.

Problem 1—A finely divided and essentially spherical granular material of average particle size D_p = 0.060 in. is contained in the tubes of a multitube reactor. The beds as dumped are 5 ft. deep and the average voidage in the bed may be assumed as $\epsilon = 0.41$.

The number and internal cross section of the tubes is such that the total flow cross section is exactly 1 sq. ft. The bed is contacted by a gas which has essentially the composition of air and is available at 50 psia. and 32 F.

For some reason it is not practical to resort to fluidization as a mode of contacting and the gas will enter the bed from the top. Based on inlet conditions, the space velocity for the contacting operation is 437 volumes of gas per hour per volume of granular bed.

For these conditions estimate the exit pressure of the gas. Also estimate the theoretical horsepower which accompanies the expansion.

Solution—For the purpose of estimating the fluid mass velocity from the space velocity, we require the fluid density at inlet conditions. This is $\rho_i = (28.9 \times 50)/(359 \times 14.7) = 0.274$ lb./cu. ft. Then $G = 437 \times 0.274 \times 5 \times (1 - 0.41) = 360$ lb./sq. ft.-hr. Next it is well to examine the type of flow. Viscosity of the gas may be taken as 0.055 lb./hr.-ft. The value of N_{Re} is approximately 3.3. The operation proceeds in the viscous flow range.

From the conditions specified a high pressure drop should be anticipated. Eq. (1) may, therefore, only give an approximation of the pressure drop.

The modified friction factor f is found to be equal to 30. Substituting the appropriate quantities in Eq. (1) gives the pressure drop Δp equal to 24.2 psi. As anticipated this is an appreciable pressure drop which causes an appreciable variation in fluid density as the gas passes through the unit. The actual pressure drop will, therefore, be higher by a considerable amount for this case.

For the purpose of illustration, the results of two separate stepwise calculations are given here. In the first instance the reactor depth has been divided into five equal sections and pressure drops are calculated for each foot. In the other case ten separate steps have been chosen with each bed element being only 6 in. high.

In these calculations, the fluid pressure at the top of each section served as the basis for calculating pressure drop by means of Eq. (1). This procedure, though satisfactory, in the limit involves many calculations. Hence the use of Eq. (6) is to be preferred.

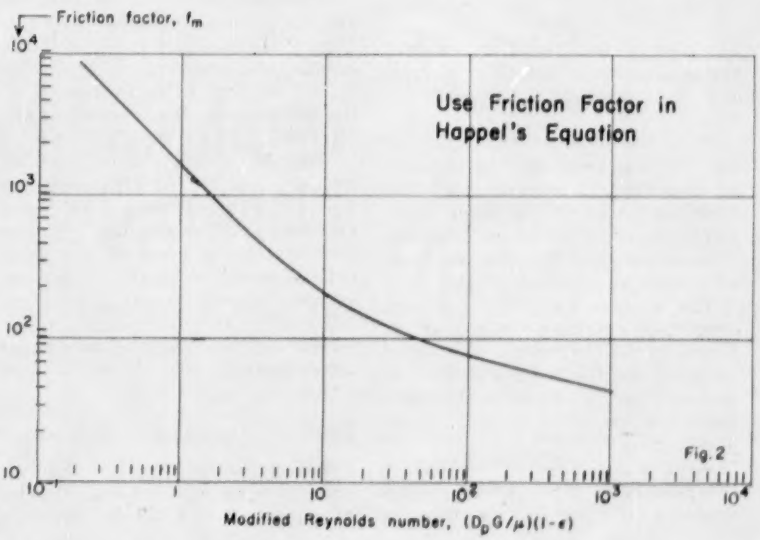
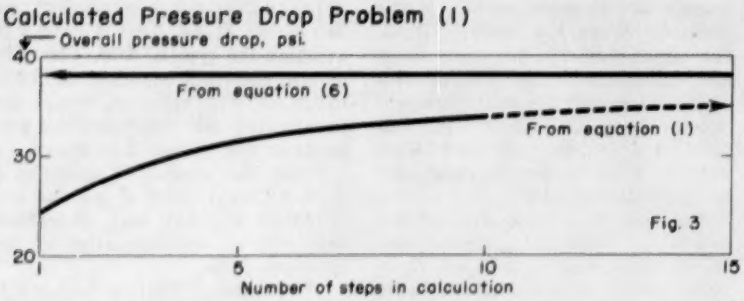
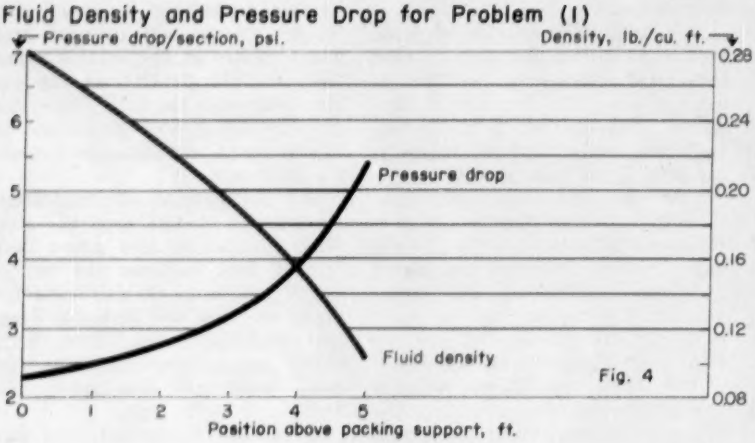


Fig. 2





Assuming the compressibility factor Z equal to 1.0 and substituting in Eq. (6) leads to:

$$(7{,}200)^2 - P_2^2 = \frac{2\times1{,}544\times(0.1)^2\times492}{32.2\times28.9}\times\left[2.3\log\frac{v_2}{v_1}+\frac{60\times5\times(1-0.41)^2}{0.0005\times(0.41)^3}\right]$$

Solution of this equation involves the application of a method of trial and error since v_2 is a function of P_2.

It is readily seen the term 2.3 $\log v_2/v_1$ is so small that in virtually all instances it may be neglected when compared to the other much larger quantity in the parentheses. Thus solving for P_2 yields the pressure drop Δp equal to 38 psi.

The various results of pressure drop thus obtained are plotted in Fig. 3 in relation to the number of steps chosen for the calculation. It is clearly indicated that in the limit, the value predicted by Eq. (6) is approached.

Application of Eq. (6) eliminates the need of a step-wise calculation procedure for estimating pressure drop. However, calculation of power requirements involves a step-wise procedure. This method is necessary because the fluid density variation through the unit must be known.

Average fluid densities are available from the step-wise analysis and are plotted versus bed height in Fig. 4. By multiplication with the respective pressure drop, also shown in Fig. 4, an indication of the horsepower requirement is obtained.

Thus for a single application of Eq. (1) and basing all volumetric flow rates on entrance conditions, the theoretical horsepower required is 3.35. On the basis of five steps this is equal to 4.67 hp. and for ten separate steps 5.35 hp. is indicated. In reality the theoretical horsepower will be slightly above the latter figure.

Problem Compares Methods

Problem 2—A spherical alundum catalyst of uniformly sized particles of D_p equal to 0.240 in. descends downwards in a 6-in. diameter tube at a rate of 75 lb./sq. ft.-min. Its average bulk density remains essentially constant at 45 lb./cu. ft. which corresponds to an average bed voidage of 50%. Air passes down the tube at the rate of 30 cfm./sq.ft. The temperature is 70 F. and the inlet pressure atmospheric. For a bed height of 10 ft., what will be the pressure drop?

Solutions—The conditions are such that the correlation of Happel applies. Hence, air density $\rho_g = (28.9 \times 492)/(359 \times 530) = 0.075$ lb./cu.ft.; mass velocity of air = $30 \times 60 \times 0.075 = 135$ lb./sq.ft.-hr.; modified Reynolds number = $0.02 \times 135 \times 0.50/0.0435 = 31$ and modified friction factor $f_m = 120$ from Fig. 2.

Substituting in Eq. (8) using consistent units, the pressure drop is found to equal 8.8 lb./sq. ft.

Another approach is to use Eq. (1). Allowance should be made first for the solids velocity relative to the gas velocity. Here catalyst velocity is $75/45 = 1.66$ fpm. Since the flow is concurrent, the net air flow relative to the catalyst is only 29.83 fpm. This corresponds to a mass velocity of $29.83 \times 60 \times 0.075 = 134.5$ lb./sq. ft.-hr. Note that catalyst velocity may really be neglected.

Next the Reynolds number is calculated and is found equal to $0.02 \times 134.5/0.043 = 62$. The friction factor f is 2.6 and state of flow factor n is 1.60. These are obtained from *Chem. Eng.*, Feb. 1957, p. 264.

Hence the pressure drop calculated from Eq. (1) is 4.6 lb./sq. ft. In this case the pressure drop is substantially less than is predicted by Eq. (8).

REFERENCES

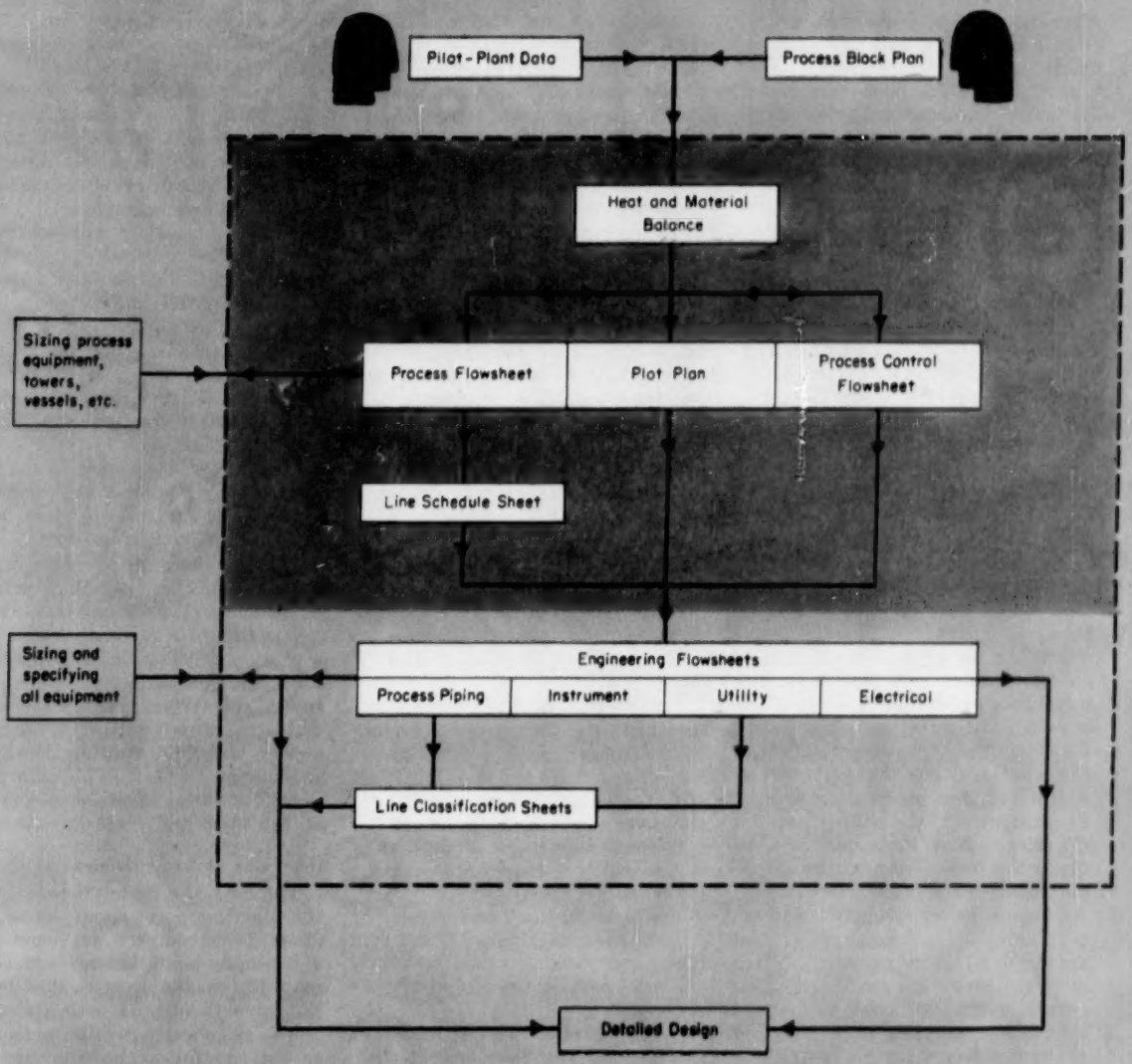
1. Happel, J., *Ind. Eng. Chem.*, June 1949, p. 1161.
2. Leva, Max, M. Weintraub, M. Grummer, M. Pollchik, H. H. Storch, *U. S. Bureau of Mines Bulletin 504* (1951).

Next Month

Our next article covers the general characteristics of flow through fluidized beds. The author will discuss:

What constitutes good fluidization?

How can we predict onset of fluidization, expansion characteristics of a granular charge and possible losses due to elutriation?



How Flowsheets Communicate Engineering Information

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The principal purpose of flowsheets is to transmit engineering information. Flowsheets are instruments of communication.

Viewed in this light, it's interesting to observe the various kinds of information they transmit, to whom they convey it and the extent to which this information is used. From the board of directors, through top management, the research and development group, the engineering departments, to the purchasing division, the manufacturers and fabricators of equipment, the constructors, the plant supervisors and on to operating personnel, flowsheets convey needed information fast.

To serve these diverse interests,

* Meet your author on p. 338.

planning of a new chemical plant or of a processing unit to be added to an existing plant will call for a group of interrelated flowsheets developed in sequence (see chart above). This group and sequence of flowsheets—common to the chemical industry — has been selected for discussion in this report to show how flowsheets transmit useful engineering information.

Definitively, the flowsheets in this sequence are graphical representations of a total concept, and they portray the system (the process and energy flow) and its components (the principal units or features of the system).

Functionally, as instruments of communication, they must present their information accurately, completely and clearly, and with a minimum of complexity. It is only when flowsheets do all these well that they serve their intended purpose fully.

The group of flowsheets shown above includes the heat and material balance, the process, the process control and the plot plan. These four tell the "what and why" of the scheme. Other flowsheets in the group include: the process piping, the instrument, the utility and the electrical. And these tell how to apply the process scheme to a specific plant installation.

Symbols on flowsheets in this report are conventional but they should not be considered standard, or even generally preferred. The several technical societies have committees working on preparation of standard symbols for flowsheets. At least one society has suggested a set of standard symbols for its engineering specialty; but truly "standard" symbols are not yet in general use.

Choosing the Scheme

Management will often have a choice of several process schemes each capable of producing the desired end result. Of these, one will be ultimately agreed upon.

When considering new, commercially untried process schemes, management is guided by whatever information emerges from laboratory or pilot-plant studies. On the other hand, in the case of commercially established process schemes, reliance is placed on their histories which will include the original research data, the original process design and the results of actual operation.

However, in both cases, because of the over-all picture they present, it's a general practice to set up at least the "what-and-why" flowsheets for each process scheme being considered. Therefore, flowsheets are important sources of information in management's preliminary studies.

In Basic Planning and Design

In basic planning the information shown on all flowsheets in the sequence serves several—if not all —of these seven specific uses:

- As aids in evaluating or confirming the economics of the scheme.
- As references when evaluating reliability and continuity.
- To check yield from both a qualitative and a quantitative standpoint.
- To select the optimum method of operation and control.
- To provide for future growth and expansion.
- To estimate the costs of and the methods for proper system maintenance.
- To bring to the forefront criteria which will permit proper site selection and development.

In the design stage, all flowsheets in the sequence convey information for these five uses:

- To determine and select, or design, the components of the system.
- To develop equipment specifications.
- To develop design drawings and general specifications.
- To develop operating manuals.
- As reference for plant operations, maintenance and future revamps.

When Flowsheets Can Be Combined

A complex plant or operating unit that involves several operations such as catalytic cracking (in which liquids, solids and gases are all handled) will normally require all the flowsheets shown in our sequence. However, simpler processes permit some combinations. For example, the process control flowsheet might be combined with the process flowsheet. The instrument flowsheet might be worked into the process piping flowsheet.

But, in the combination, the function of flowsheets as instruments of communication must be considered and preserved lest complexity defeat the purpose.

In this report, to illustrate the possibilities of such combinations, we have used the flowsheets of a small fatty acid plant in several instances. This process was chosen because it is an example of a comparatively simple process scheme. Yet, it involves several operations: fluid flow, liquid-gas contacting, heat transfer and liquid-gas separation.

To illustrate a situation where flowsheets ought not be combined, we have used the flowsheets of a more complex fractionation unit. Note also that since our use of a plot plan in this report is merely to show its proper role in flowsheet sequence, the plot plan does not show any particular process.

When an integrated process plant is to be built (for example, a petroleum refinery) in which a variety of end products are manufactured, a process block plan is prepared. Each block represents a particular unit of the system; and each shows the physical properties of all materials entering, flowing through and leaving the unit. This information is essential to the development of the heat and material balance.

Heat and Material Balance

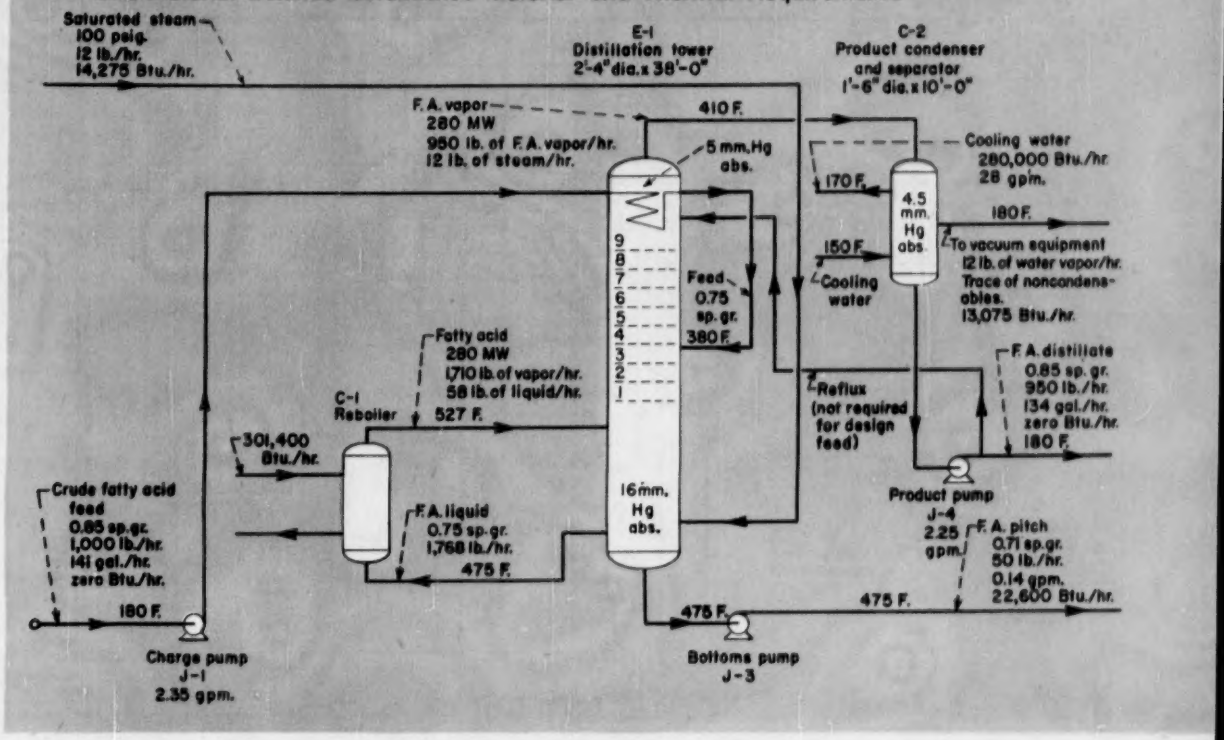
The heat and material balance is the starting point from which all other flowsheets are developed. It will usually be in tabular form or it may be rendered as a flowsheet. We have illustrated both styles.

The flowsheet rendition presents, in embryo form, the first picture of flow in the system.

Purpose of the heat and material balance is to show the rate of flow; physical state of all materials required for the process from feed to end product; all points in the system at which heat must be added or removed, and the quantities in each case, together with their respective temperatures, pressures and rates of flow. These data may be, and often are, repeated in the process flowsheet. But it is the function of the heat and material balance to establish them.

Material and energy requirements shown are calculated from accurate information concerning physical properties of the process materials. If these data are not available from previous experience, handbooks, articles or from manu-

Heat and Material Balance Establishes Material and Thermal Requirements



facturers, they will have been determined in laboratory and/or pilot-plant operations.

Next, the Process Flowsheet

The process flowsheet is a representation of essential process equipment and the sequence of material flow in a given process. It is developed mainly from data shown on the heat and material balance.

For a simple process the process control flowsheet may be combined with the process flowsheet. We have shown an example of this on p. 252.

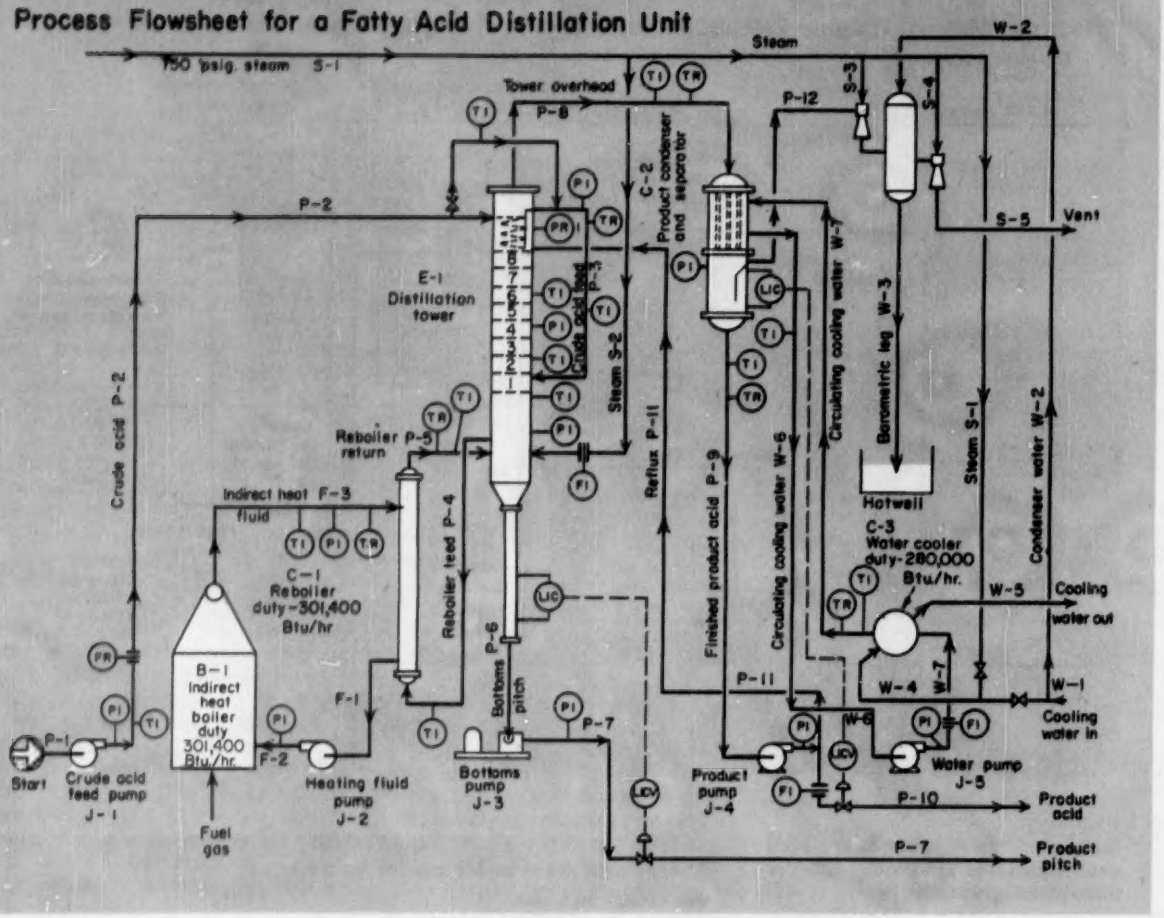
Material quantities and thermal requirements for the system were established by the heat and material balance. Now it's the function of the process flowsheet to translate these into terms of individual major equipment items and to provide the information from which they are sized physically in relation to their purposes and duties or capacities.

As rendered, the process flowsheet is devoid of detail. It shows only the main process lines interconnecting the equipment and only the valving that is considered absolutely necessary to the proper operation of the system.

Physical properties, quantities, temperatures and pressures of the materials as they flow through the system are important parts of the process flowsheet. These values will be indicated in one of three ways: by tagging each line directly to show the pertinent data; by identifying each line with a letter or number which will refer to a similarly lettered or numbered line schedule section on the flowsheet

Abbreviated Heat and Material Balance

Heat Entering the System		
In feed	0 Btu./hr.	
In steam	14,275 Btu./hr.	
At reboiler	301,400 Btu./hr.	
Total heat entering system		315,675 Btu./hr.
Heat Leaving the System		
In distillate	0 Btu./hr.	
In pitch	22,600 Btu./hr.	
From condenser	13,075 Btu./hr.	
In cooling water	280,000 Btu./hr.	
Total heat leaving system		315,675 Btu./hr.
Process Materials		
Feed in		1,000 lb./hr.
Fatty acid distillate out	950 Lb./hr.	
Fatty acid pitch out	50 lb./hr.	
Total process materials out		1,000 lb./hr.



Line Schedule Sheet

Line Number	Flow Medium	Quantity Flow, Gpm. or Scfh.	Quantity Flow, Lb./Hr.	Temp. °F.	Press. psi.	Density Lb./Ft.³	Density, Lb./Gal.	Sp. Gr. At 60°F.	Sp. Gr. At Flow Temp.	Expansion Coeff.	Chemical Formula	Mol. Wt.	Line Size	Press. Drop / 100 Ft.	Est. Line Length	Line Press. Drop	Line Origin	Line Termination

itself; or shown separately on the line schedule sheet.

Tagging is used when the process is simple and there is little possibility of the tags complicating the flowsheet. Identifying each line on the flowsheet is practical when space permits and the amount of data to be shown is limited. But in cases where the process is complex and the data voluminous, the third method is best. Identifying each line or preparing a separate line schedule sheet are quite common and are more practical than trying to tag each line directly since changes made in the physical or chemical properties will not require a revision of the flowsheet.

Interrelation of Flowsheets

Information flows from one flowsheet to another. Using the fatty acid plant as an example, reference to its heat and material balance—whether it be rendered as a flowsheet, or in complete detailed tabular form—will show that heat must be added to the bottom of the distillation tower. This indicates the need for a heat source.

Since economic and practical considerations preclude setting up a heat-exchange surface within the tower itself, an external heat exchanger (a reboiler, in this case is required). Moreover, safe operating practice and economy established the need for a low-pressure indirect-heating system to maintain the required temperature. All of this immediately dictates the need

for a reboiler, a return pump for the heating fluid, a boiler or heater, fuel, piping and related instruments. These determinations all are shown on the process flowsheet.

The heat and material balance shows the amount of heat that must be added to the bottom of the distillation tower. From this we will calculate the heat transfer surface required for the reboiler and the amount of heating fluid required by the indirect heating cycle based on the heat capacity of the fluid, itself. The quantity of heating fluid which must be recycled establishes the capacity of the return pump, and the size of all interconnecting piping.

In this illustration we started with a single fact transmitted by the heat and material balance: the need for heat at the bottom of the distillation tower. In the development of the process flowsheet it was expanded to show the types and design data for all equipment required to accomplish the necessary result. In turn, the process flowsheet communicates information essential to the creation and development of the engineering flowsheets, particularly the piping flowsheet.

The illustration serves another purpose. It demonstrates the importance of the process flowsheet which is, in fact, the transition wherein the basic calculations of the heat and material balance are translated into a graphical representation supported by detailed computations. The process flowsheet is the "transmittal slip" from which all subsequent flowsheets, including the process control flowsheet and the plot plan, are developed.

What the Process Flowsheet Says

The process flowsheet transmits information for the following important uses:

• Cost estimates. Since the system's major component requirements are shown, a preliminary estimate of equipment costs can be made.

• Yield. Complete information is given to show the yield used in the design of the process.

• Control and instrumentation. Critical points in the process that must be controlled accurately to obtain the desired yield are shown. From this information, the process and instrumentation specialists will determine the type of instrumentation required to effect the most efficient control of process variables such as temperature, pressure, flow rates, liquid levels, etc.

• Selection, design and specification of components. Since the process flowsheet shows the operations involved, it dictates the kind of equipment needed. For example, the information supplied shows the project coordinator, the process engineer, the plant superintendent and others under their supervision where vacuum or pressure are needed; where raw material, intermediate and finished product storage facilities are required; and equipment necessary for such operations as distillation, filtration, pumping, heat exchange, etc. All this leads to a determination of the system's components in terms of the number, types, sizes and/or capacities required, and ultimately to their specification.

• Utility requirements. The process flowsheet, along with the heat and material balance, is basic to the selection of the system's utilities. These not only show where heat must be added or removed from the system, but also the magnitudes involved and the extremes of temperature.

This information immediately shows if low-pressure steam is adequate for processing or if high-pressure steam or other heating system is needed. It will indicate whether the requirement will call for some special indirect heating system, or direct-fired furnaces. This supplies the necessary information to the project coordinator and the engineering group concerned with planning the utilities.

• System maintenance. The representation of the system's major components together with the physical characteristics of material handled will give the first indication of the probable maintenance requirements.

• Safety considerations. The process flowsheet reveals the hazards in the scheme and it is the starting point for all safety planning. In this respect it will influence the development of the plot plan, the selection of personnel safety equipment and the selection, design and specification of plant protective devices. Similarly, it is the basic reference when drafting safety rules, procedures and manuals.

• Plant operation. The process control flowsheet gives the first over-all picture from which the plant superintendent, and others concerned with production, can determine the number and quality of personnel required for the system's operation, as well as the extent of the training they will need.

Process Control Flowsheet

A process control flowsheet is a graphical representation showing the basic instrumentation and control items required by the process and its utilities. Like the process flowsheet, from which it is developed, it is devoid of detail, and it shows only as much of the process and utility equipment and piping as necessary to indicate the functions of the basic instruments.

The instrument engineer develops the process control flowsheet with the collaboration of the process engineer. The process engineer knows what the scheme must accomplish and generally he will have a fundamental idea of how the process should be controlled to attain the desired end result.

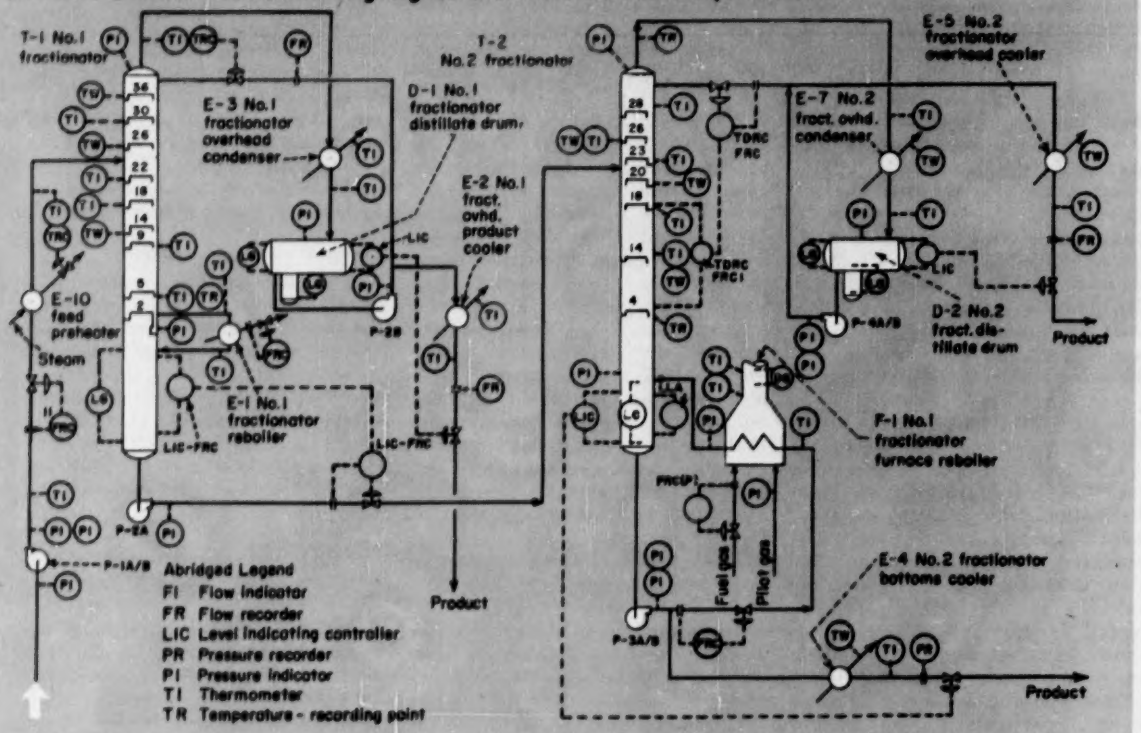
On the other hand, the instrument engineer is a specialist with specific knowledge of instruments and controls. It is his responsibility to determine whether the scheme can be instrumented as the process engineer desires or to establish alternate and better methods.

We have shown (on p. 252) the process control flowsheet combined with the process flowsheet. The process scheme delineated is comparatively simple, and its instrumentation requirements are not elaborate. The combination of flowsheets is permissible since the essential element of clarity is preserved.

However, the fractionation system shown on p. 254 is more complex. Here more extensive instrumentation is used for the process, and in addition, instrumentation is needed for a larger utility system. Consequently, a separate control flowsheet is required to avoid complexity and confusion.

The process control flowsheet on p. 254 shows a typical example of an instrumentation problem resolved for the control of tower T-2. Bottoms from tower T-1 serve as

Process Control Flowsheet Highlights Instrumentation Requirements



feed for T-2. Feed rate to T-2 will vary with the liquid level in the bottom of T-1, and the variation will upset the temperature differential—critical to the product's quality—in tower T-2.

Desired temperature differential in tower T-2 is measured at plates 4 and 18 by a temperature differential recorder-controller with a flow rate controller component that will reset the reflux rate. This maintains the desired differential regardless of any variation in the rate of feed from tower T-1.

Resolving such a problem in the design stage and setting the solution down on the process control flowsheet transmits a tremendous amount of information for use in plant operator training courses.

In a very real sense, the process control flowsheet is a process review. Its preparation and study will often reveal a better method of control, or the possibility of eliminating some items of equipment and their related accessories.

The process control flowsheet is the basic reference for instrumentation specification and panelboard planning. Moreover, it assists in the development of operating manuals since it reveals where alarms and safety devices are required. Data transmitted by the process control flowsheet help develop procedures to be followed in case of utility failures or other emergencies.

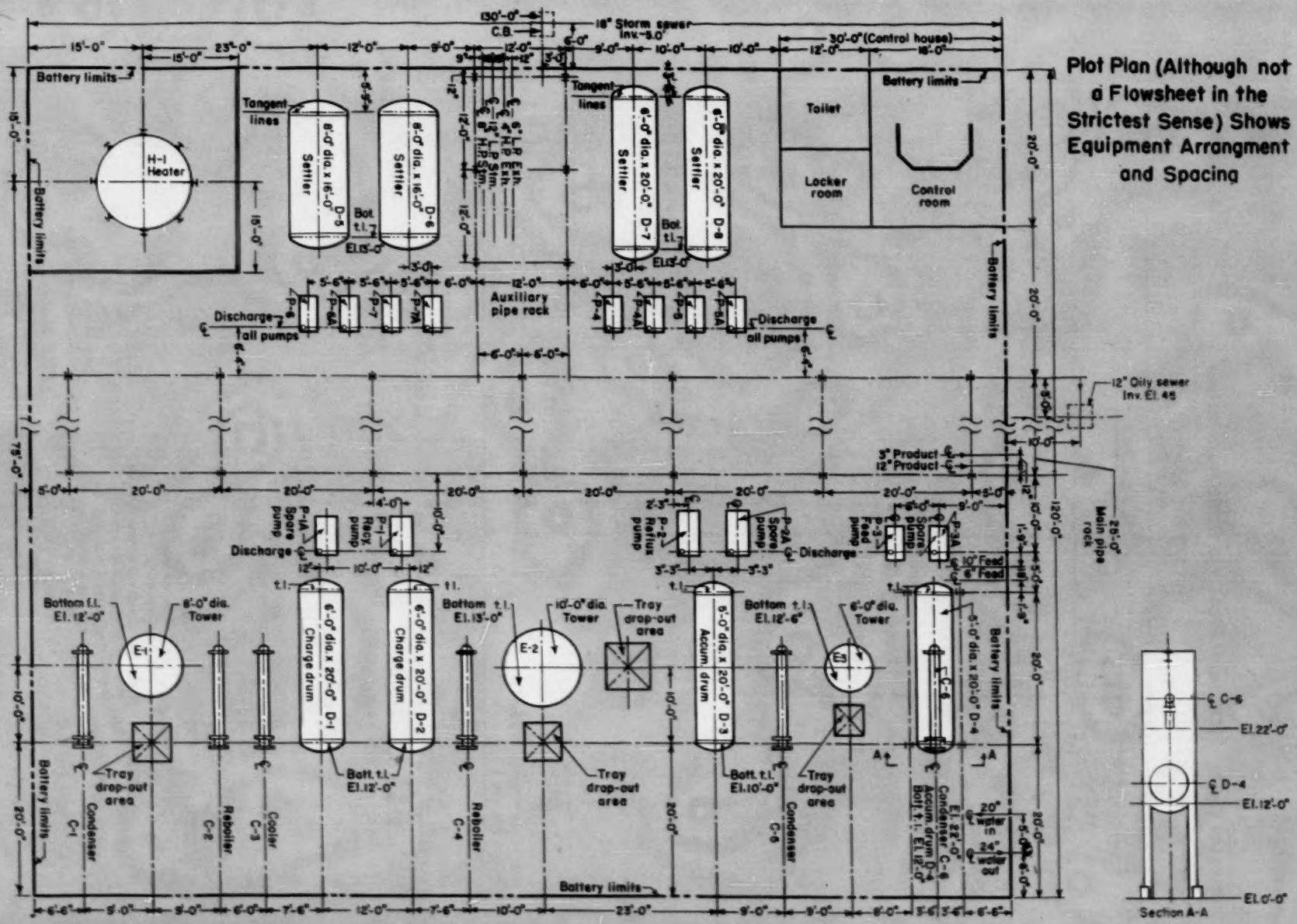
Plot Plan: Almost a Flowsheet

Layout of a chemical plant, or a processing unit, is determined basically from functional requirements. Therefore, the plot plan (purpose of which is to show the equipment arrangement in plan) is closely related to the flowsheets even though, in the strictest sense, it cannot be defined as one.

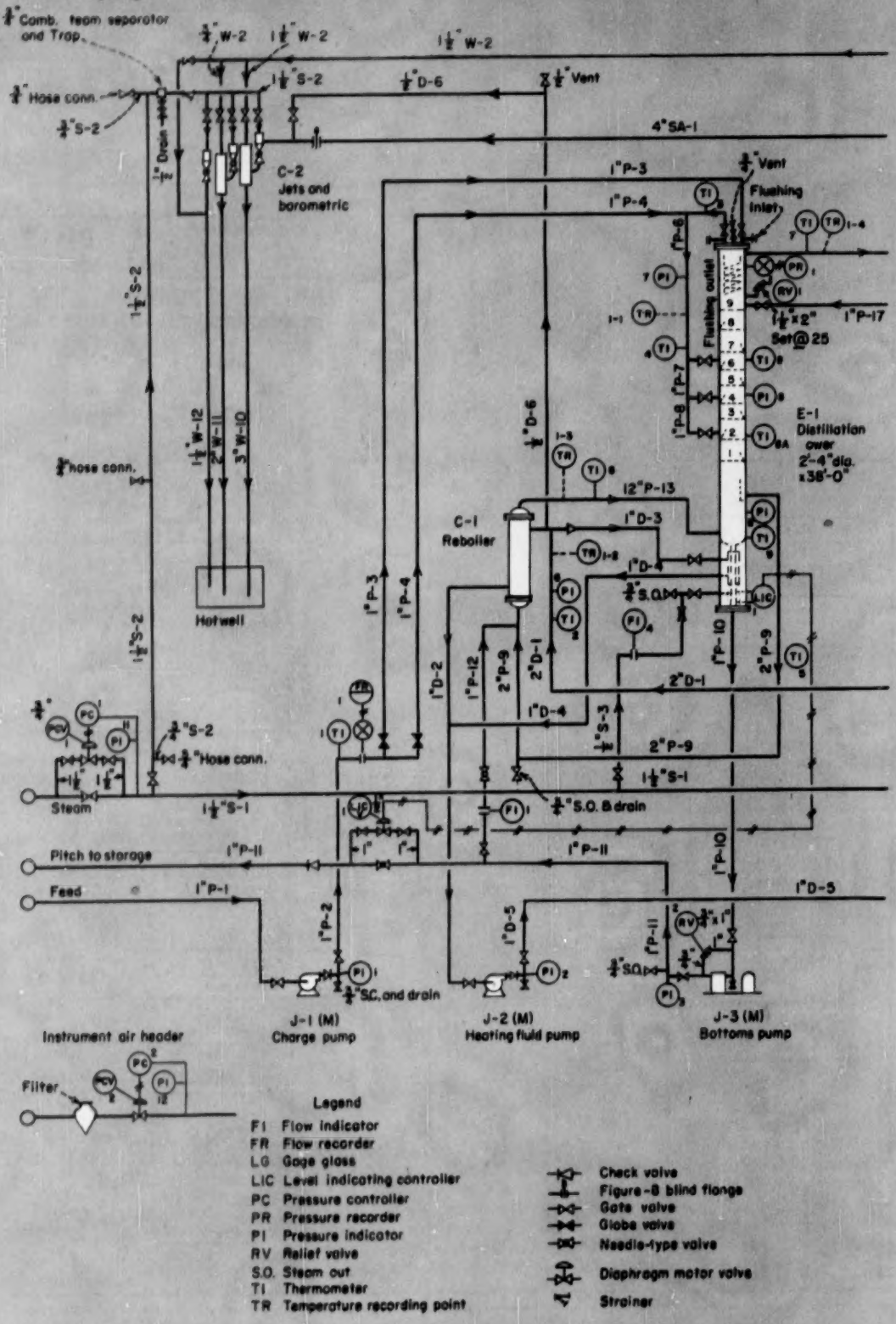
Even before the flowsheets are started, a general knowledge of the process and its utilities will control preliminary selection of the site with safety, sufficient space and economy as paramount considerations. Other considerations such as adequate spacing between different processing units and other plant elements such as storage tanks boiler plants and other utilities; climatic and meteorological conditions such as flooding, wind, earthquakes, etc.; access for fire-fighting apparatus; availability of transportation; and the nearness of raw materials and/or markets are important factors in selecting a plot.

The plot plan on p. 255 shows typical equipment arrangement and spacing.

When the site is selected, spacing of units to provide adequate clearances so that possible fires or explosions in one will not cause damage or spread to others is a most important consideration in the development of the plot plan. It's not possible to give inflexible rules for such spacing. However, equipment operating at low pressures and containing small amounts of flammable material can be spaced closer than high-pressure equipment. Fired heaters should be kept at a maximum distance from equipment, process drains, etc. which can release large amounts of flammable materials.


Plot Plan (Although not a Flowsheet in the Strictest Sense) Shows Equipment Arrangment and Spacing
Battery limits
H-I Heater
Tangent lines
Settler
D-5
D-6
D-7
D-8
Bot. t.l. El.13'-0"
Auxiliary pipe rack
Discharge tail pumps
Discharge oil pumps
Toilet
Locker room
Control room
30'-0" (Control house)
18" Storm sewer Inv.-5.0'
C.B.
12" Oily sewer Inv. El. 46
3" Product
12" Product
Main pipe rack
P-1A Spare pump
P-1 Recy. pump
P-2 Reflux pump
P-2A Spare pump
P-3 Feed pump
P-3A Spare pump
Discharge
10" Feed
6" Feed
Bottom t.l. El. 12'-0"
8'-0" dia. Tower
E-1
6'-0" dia. x 20'-0" D-1 Charge drum
6'-0" dia. x 20'-0" D-2 Charge drum
Bottom t.l. El.13'-0"
10'-0" dia. Tower
E-2
Tray drop-out area
6'-0" dia. x 20'-0" D-3 Accum drum
Bottom t.l. El.12'-6"
6'-0" dia. Tower
E-3
6'-0" dia. x 20'-0" D-4
Batt. t.l. El.12'-0"
Batt. t.l. El.10'-0"
Condenser C-1
Reboiler C-2
Cooler C-3
Reboiler C-4
Condenser C-5
Condenser C-6
Accum. drum Bott. t.l. El. 12'-0"
20" t. water in
24" t. water out
Section A-A
℄ C-6
El.22'-0"
℄ D-4
El.12'-0"
El.0'-0"

Process Piping Flowsheet Picks Up Basic Information...

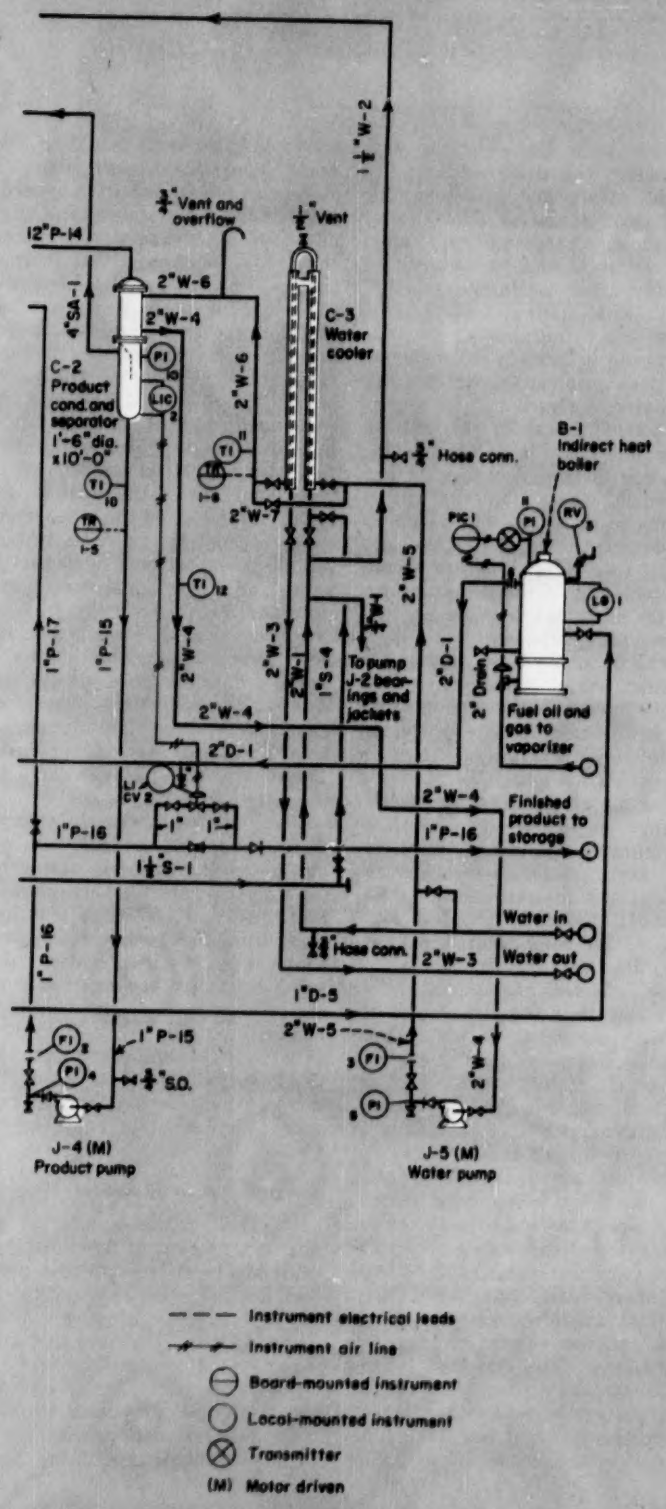


Legend

FI	Flow indicator
FR	Flow recorder
LG	Gage glass
LIC	Level indicating controller
PC	Pressure controller
PR	Pressure recorder
PI	Pressure indicator
RV	Relief valve
S.O.	Steam out
TI	Thermometer
TR	Temperature recording point

- Check valve
- Figure-8 blind flange
- Gate valve
- Globe valve
- Needle-type valve
- Diaphragm motor valve
- Strainer

. . . and Design Detail



After the heat and material balance and the process flowsheet have progressed far enough to give a fairly complete picture of the type and duty of the equipment required, the preliminary plot plan is started.

The preliminary plot plan influences the choice of equipment. For example, the first attempt at an arrangement might be made with 12 heat exchangers side by side. But the amount of space allotted for heat-exchange equipment will not permit the installation of this number. To aleviate this situation, where pairs of exchangers are selected for a particular service, they can be stacked.

Another alternate is to build a two- or three-level structure to reduce the plan area that might be required.

Critical lines can be sized and pressure drops determined by using the plot plan to draw a schematic of these lines to determine their runs.

If a unit is being added to an existing plant, the preliminary plot plan is helpful in determining from which plant utility mains the unit's headers are to be taken, and these mains can be checked for the additional flows required. The preliminary plot plan will include the following information: over-all plot size, the relative position of equipment using estimated spacings (final locations are not set until after the piping layouts are complete), elevations of any equipment support structures, elevation of lower tangent lines of towers, the low points of horizontal drums and the location of lines entering or leaving the battery limits.

The following fall into this latter category: feed and product lines; steam, air and water lines; and storm or chemical or oily sewer lines. In the case of sewer lines, inverts as well as their locations must be shown.

Because of the volume of information transmitted by the plot plan, there is little question as to its right to be placed in the flowsheet sequence. It is indispensable to management's economic studies. It serves as a check on the reliability and continuity of the scheme from a perspective entirely different from that of other flowsheets. When changes or plant expansions are considered, it will be one of the first flowsheets referred to. And

Line Classification List

Line			Origin	Termination	Design Cond.		Thick. Insul.	Size & No. Tracers	Flowing Medium
No.	Spec.	Size			°F.	Psig.			

it provides a bird's-eye view of maintenance problems.

The Engineering Flowsheets

At this point, the system's process scheme has been established; the "what-and-why" flowsheets spell it out. Now it remains for the engineering flowsheets to interpret the information communicated, and to finalize the scheme by providing all data in detail for the actual design and specification of each of the system's components.

The process piping flowsheet is the first of this group. When the process is simple, and its components are few, and its instrumentation and utility requirements are not elaborate, the instrument and utility flowsheets are combined with it. An example of this combination is shown on p. 256. However, complex processes will require separate flowsheets.

The process piping flowsheet, as a separate rendition, shows all equipment, its interconnecting piping with runs and sizes, all valving including control and safety valves, all instrument connections, and all points where utilities are connected to the system. As a combination flowsheet it will also show directly all instruments and utility piping.

As an example of how engineering flowsheets detail the system's components, and specifically how the process piping flowsheet differs from the process flowsheet, note that the process flowsheet dictates the need for a water cooler (item J-3) but it does not show the valving required. The process piping flowsheet picks up the basic information, and it adds complete detail by showing a bypass with appropriate valving on the cooler's shellside, while shut-off valves are shown on the tubeside.

Each process and utility line on the flowsheet is identified by a number which corresponds to a numbered line on a line classification list (see above).

This list is an important adjunct of the flowsheet. In tabular form, it shows each line's origin and destination, the design conditions of temperature and pressure, the thickness of insulation, and the size and number of tracer lines, if any. It serves as a complete record of lines for check against a line-by-line material listing, and it is a further aid to purchasing and expediting as it catalogs all material of critical specification which must be ordered early.

Primary purpose of the process piping flowsheet is to supply information to the design drafting department where all piping will be laid out to scale. It is kept up to date during the course of the job, and it notes any changes found necessary during the design stage. It is the basis for checking all final design piping drawings.

Perhaps, more than any other flowsheet, this flowsheet grants validity to the premise that the plot plan is an essential part of the sequence under discussion. Used in conjunction with the plot plan, the process piping flowsheet shows the designer the size of any given line, its beginning and end, its temperature and pressure, specification, valving, and instrumentation. Accordingly, the final physical locations of all components are now determined.

The process piping flowsheet, again used with the plot plan, is an accurate source from which preliminary estimates are made of the cost of all piping, valves, fittings, and insulation required. Moreover, a preliminary bill of materials is drawn up for all these items.

The instrument department uses this flowsheet, along with instrument specifications, to determine the method of connecting all instruments, and the material to be used for their installation. Similarly, the instrument department calculates the instrument piping requirements. This flowsheet shows all pumps and it identifies them by separate symbols as either steam- or electric-motor driven. This information is essential for planning power requirements and the electrical department will size the motors and establish wiring needs.

Furthermore, the electrical engineer will find that this flowsheet shows the location of all thermocouples, and it is used to establish the height of electrical leads, while the plot plan is the basis for determining the horizontal distance from the equipment to the panelboard. Heights of vessels and like components indicate the number of platforms needed, and the lighting facilities can be planned.

Since it shows the number and types of valves, and the number and types of instruments, the process piping flowsheet will indicate the extent of the maintenance necessary for these items.

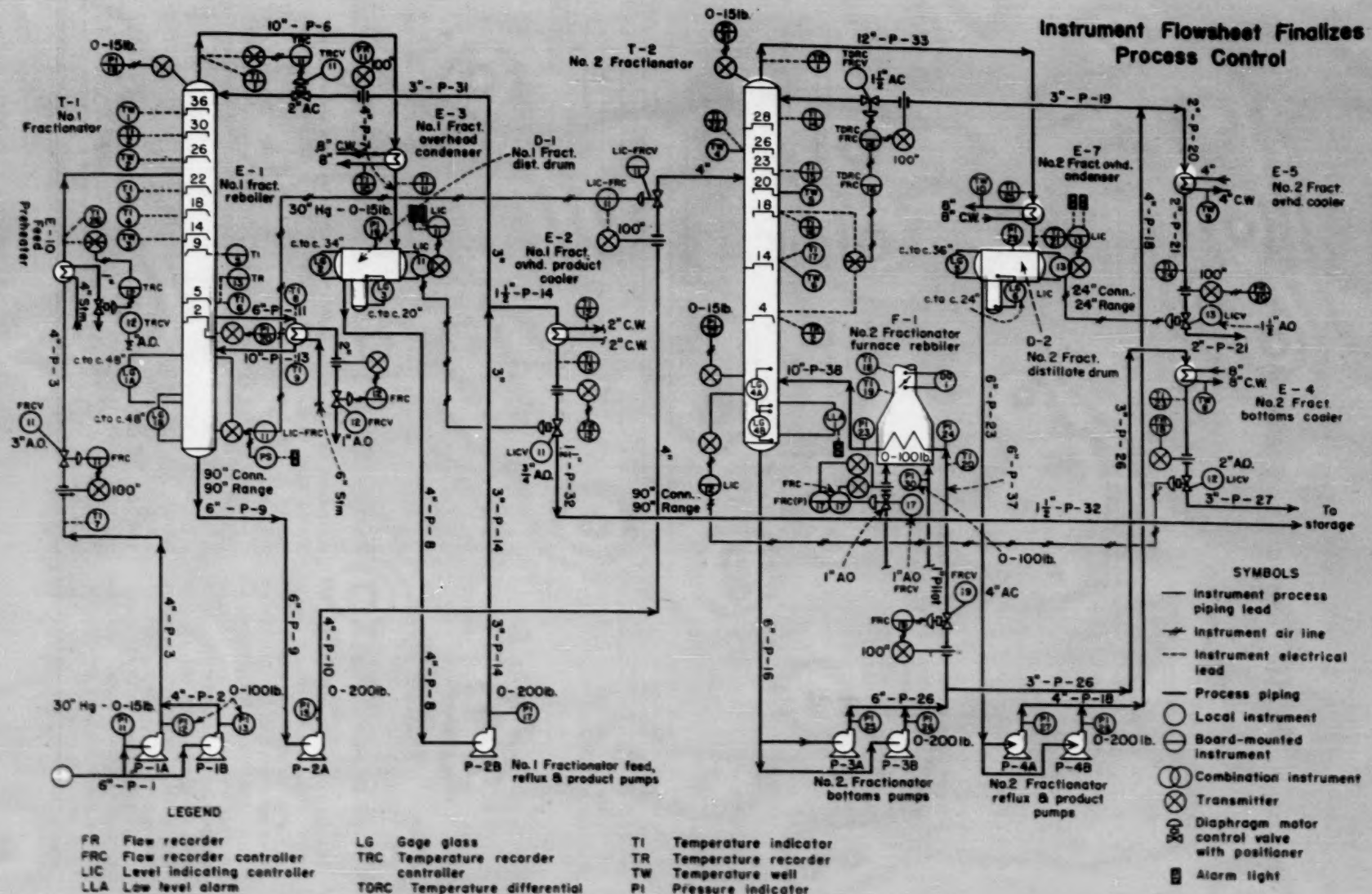
Process piping is a conventional flowsheet used principally for unit work, but it does not always lend itself to all applications. Therefore, mention of two other types and how they are used is in order. These are the plotwise and the isometric renderings.

The plotwise flowsheet is particularly adaptable to tank field piping, pumping manifolds, and utility piping yard runs. The equipment is indicated in its relative plot location. Pipe headers are shown in their approximate location with sub-headers and branch lines shown in their proper sequence off the headers.

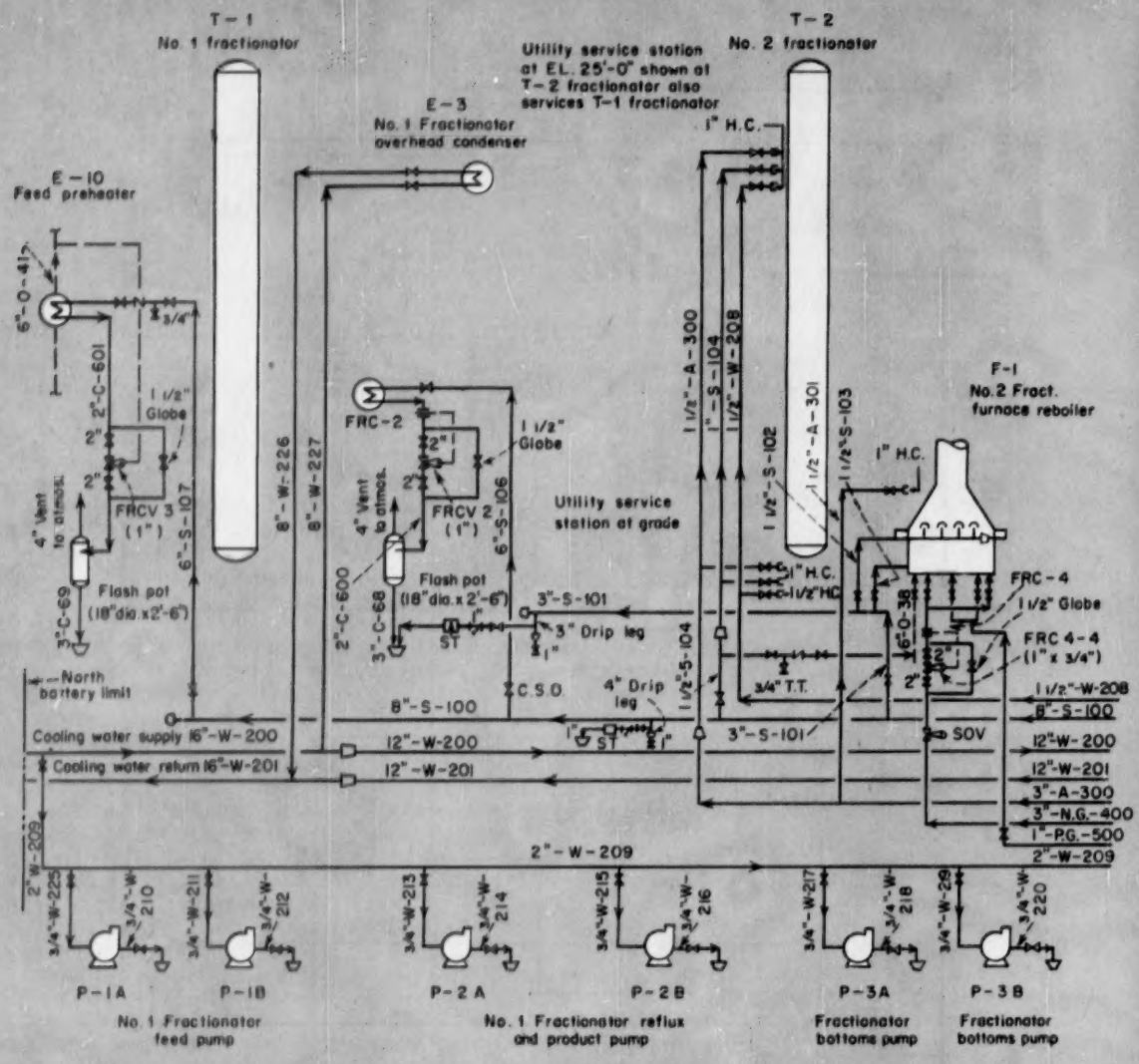
In both unit and offsite planning, the isometric flowsheet often gives a better pictorial representation of what the project engineer envisions.

The Instrument Flowsheet

Intricate processes will not permit the instrument flowsheet to be combined with the process piping flowsheet. The result would be complicated and confusing. Consequently, such processes require a separate instrument flowsheet such as is shown on p. 259. Purpose of the instrument flowsheet is to finalize the determinations made on the process control flowsheet, which


Instrument Flowsheet Finalizes Process Control
T-1 No.1 Fractionator
T-2 No. 2 Fractionator
E-1 No.1 fract. reboiler
E-2 No.1 Fract. ovhd. product cooler
E-3 No.1 Fract. overhead condenser
E-4 No.2 Fract bottoms cooler
E-5 No.2 Fract. ovhd. cooler
E-7 No.2 Fract.ovhd. condenser
E-10 Feed Preheater
D-1 No.1 Fract. dist. drum
D-2 No. 2 Fract. distillate drum
F-1 No.2 Fractionator furnace rebboiler
P-1A
P-1B
P-2A
P-2B
No.1 Fractionator feed, reflux & product pumps
P-3A
P-3B
No.2. Fractionator bottoms pumps
P-4A
P-4B
No.2 Fractionator reflux & product pumps
To storage
SYMBOLS
Instrument process piping lead
Instrument air line
Instrument electrical lead
Process piping
Local instrument
Board-mounted instrument
Combination instrument
Transmitter
Diaphragm motor control valve with positioner
Alarm light
LEGEND
FR Flow recorder
FRC Flow recorder controller
LIC Level indicating controller
LLA Low level alarm
LG Gage glass
TRC Temperature recorder controller
TDRC Temperature differential recorder controller
TI Temperature indicator
TR Temperature recorder
TW Temperature well
PI Pressure indicator
PS Pressure switch

Prepare Utility Flowsheets to Give a Comprehensive Picture . . .



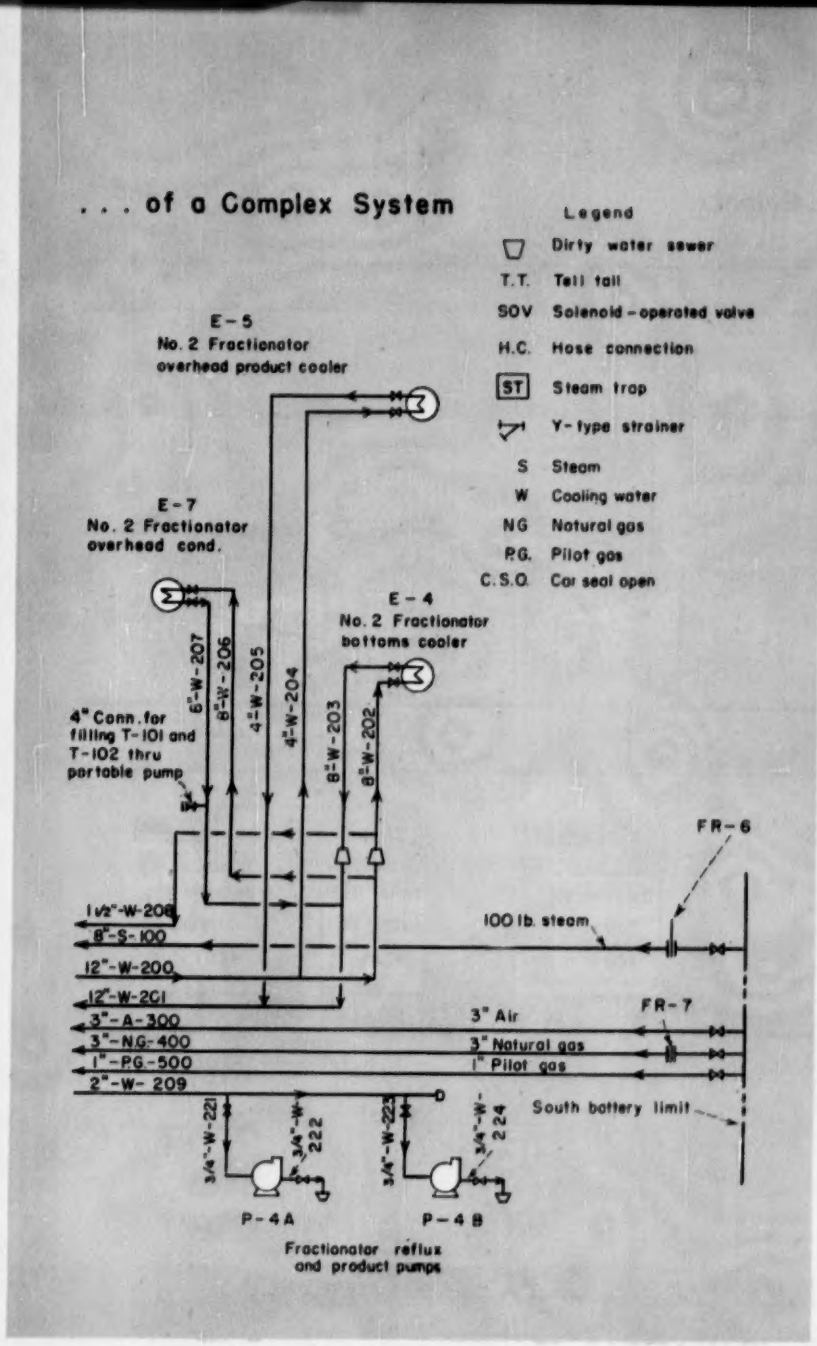
merely outline the instrumentation required by the system.

The instrument flowsheet must show every item of instrumentation in its relation to the process, its piping, and its utilities. This includes all process and utility lines, and equipment required to show the location and arrangement of the instruments. Vessel sizes, bypass lines, valves (with the exception of control valves) and like items not subject to instrumentation are not shown on this flowsheet. However, the internals of equipment such as trays, baffles, or piping must be shown if they are related to the position of instrument connections.

Legends defining symbols appear in tags on the flowsheet. The Instrument Society of America has prepared standard symbols and, although not yet adopted by the American Standards Association, their use is recommended. Many companies have their own individual symbol standards and where these prevail, they will, of course, be used. ISA symbols are used in all flowsheets shown here.*

The instrument flowsheet is used in the preparation of instrument specifications, requests for bids, purchase requisitions, and control board planning whether there are several simple control boards, or one or more large control rooms with elaborate graphic panels.

* Original flowsheet drawings prepared by the author's staff showed instrument designations and instrument identification numbers inside the balloon taggings. Due to mechanical limitations, it has been necessary for us to show instrument identification numbers outside some balloons in our illustrations.—Editor.



Since the instrument flowsheet shows the process and all of its instruments, it is used effectively for training plant operating personnel in the pre-startup period, and it enables the operators to become thoroughly familiar with the process and its method of control. Moreover, this flowsheet will be used for developing and illustrating the text of operating manuals.

Finally, it always becomes a part of the contractor's specifications for the installation of the operating unit.

Utility Flowsheets

The utilities required for a process unit usually consist of steam, cooling water, compressed air, and fuel. Other systems such as seal oil for sealing packing glands, and inert gas for blanketing certain products are also considered utilities, and these are shown on the flowsheet along with steam, cooling water, etc. Fire protection systems usually are represented by a separate flowsheet.

As in all flowsheets, the aim in preparing utility flowsheets is to present a comprehensive picture of a complex system as clearly as possible. Therefore, for units with simple processes, the utilities are shown on the process piping flowsheet so that the complete representation is presented on one sheet for easy perception and reference. For complex processes, a clearer picture is presented when the utility piping is shown on a separate utility flowsheet.

This flowsheet shows all the usual details of piping and equipment, and the layout and design of all piping with valving, line sizes and specifications, and connections to furnaces, pumps, exchangers, condensers, reactors, vessels, etc.

Arrangement of the equipment on the flowsheet must be in the proper sequence so that changes in header sizes can be shown easily as branch connections are taken off. Process piping is not shown on this flowsheet except where a utility is tied into it, in which case the process line is rendered in phantom and reference is made to the process piping flowsheet for continuation.

The utility flowsheet, along with the process piping flowsheet and the plot plan, is used by designers for the layout and detailed design of the piping. It is used to develop operation manuals, operating instructions, and when revised for the "as built" condition of the unit, it is used in operation and maintenance work.

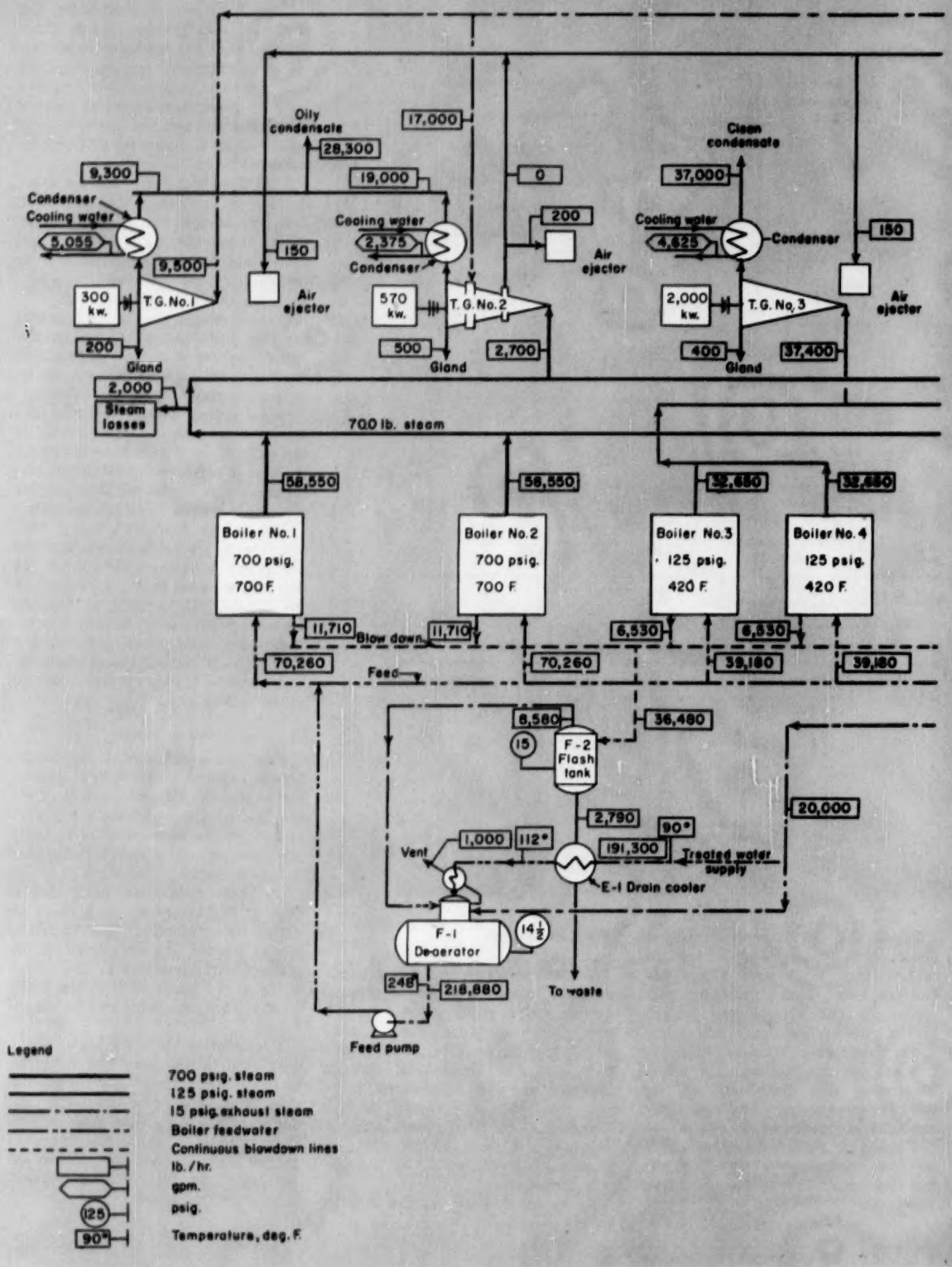
The Utility Block Plans

For laying out the utility distribution systems of large plants, block plan flowsheets (see p. 264) are used. Each utility is represented on its own block plan since the problems of distribution differ in every case.

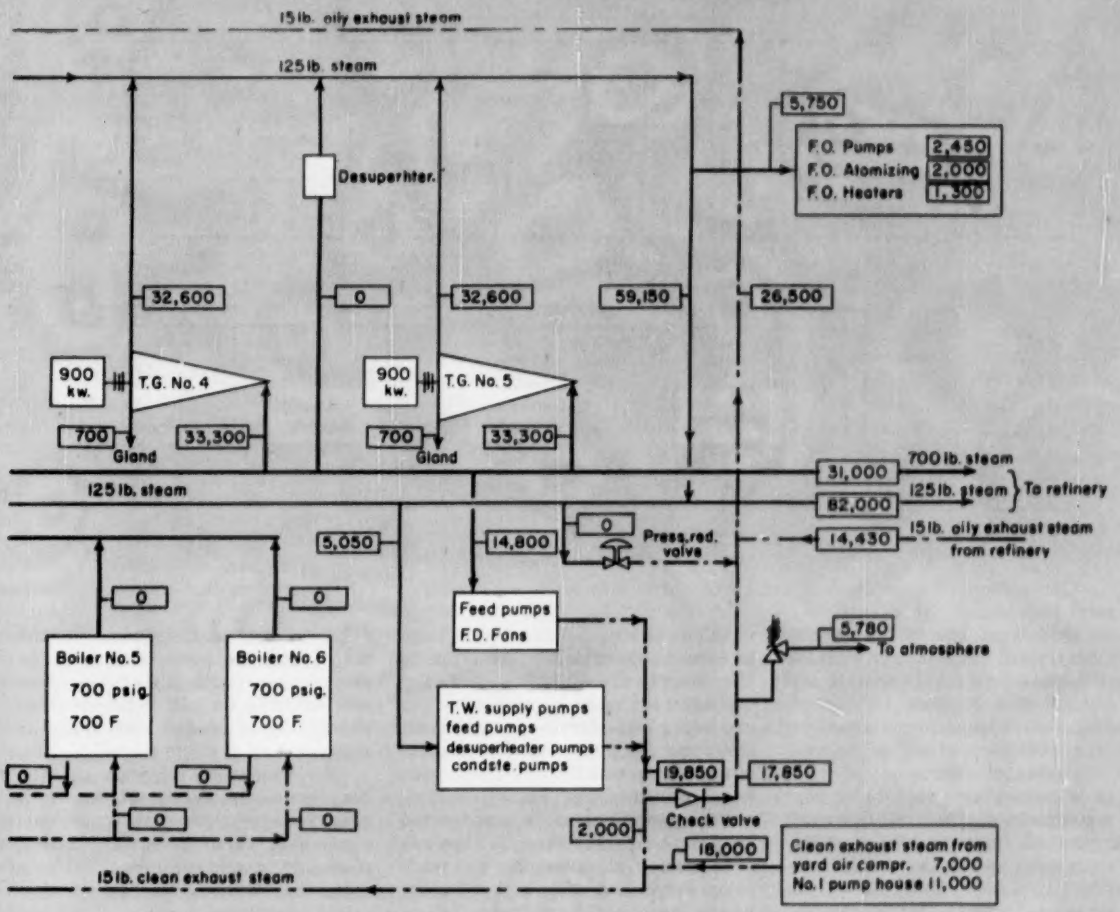
On these flowsheets each individual utility is shown as a block in which is indicated its required loads. Blocks are arranged in the same relative position as the actual units in the plant so that the loads on distribution mains can be established.

Preparation of block plans is the first step in planning the distribution system. They are indispensable in determining the total load demands for economic studies, and they may even show the expected future loads so that anticipated expansions can be considered early in the design stages.

Power Plant Heat and Material Balances . . .

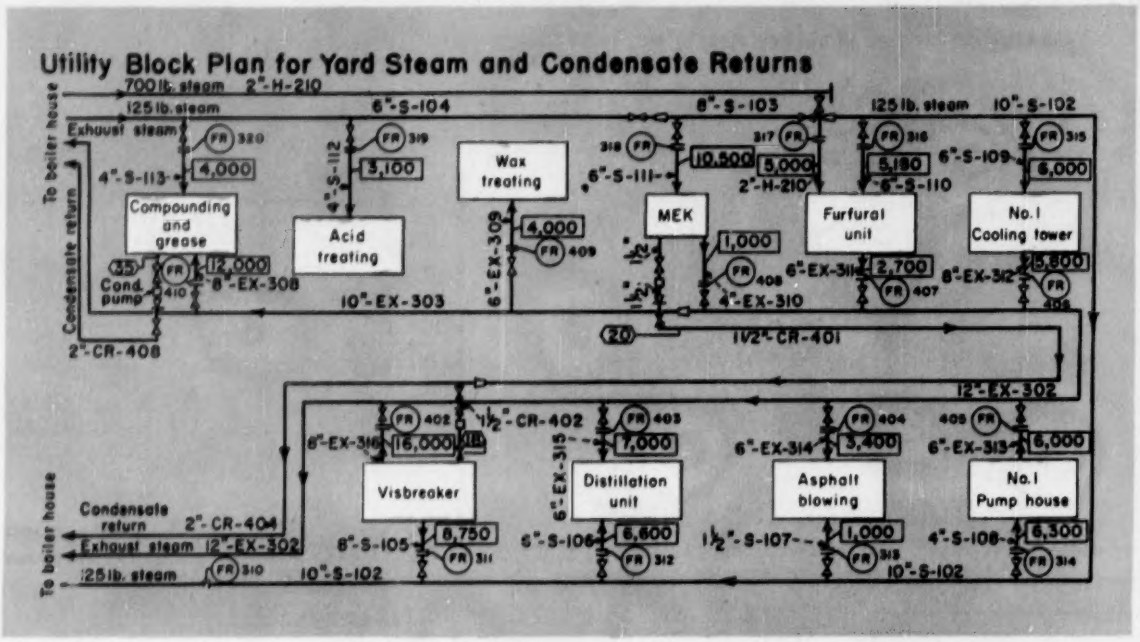


. . . Tell Management Whether to Buy or Generate Power



Typical Power Plant Balance

Case No. 2	kw	700 lb. steam	125 lb. steam	15 lb. steam make	15 lb. steam use
Refinery demand	4534	31,000	82,000	32,430	—
Power plant auxiliary load	191	14,800	11,300	19,840	20,000
Total	4725	45,800	93,300	52,270	20,000



As details of the utility system are developed, they are represented on the block plan for discussion and study of such matters as dependability, maintenance, provisions for future growth, method of control, and location of source.

In its final stage, each block plan is a complete engineering flowsheet showing all features of the utility system such as valving, instrumentation, bypasses, line sizes, and their specifications. It is used by the designers for the layout of the yard piping between the source of the utility and the consuming units. It becomes part of the construction specifications, and after the plant is built, it is used for operation and maintenance work.

Moreover, these block flowsheets are used in the definitive design stage to develop sizes and specifications for cooling towers, circulating pumps, air compressors, fire pumps, etc. But to meet the demand load for steam and electric power for large plants, further study is required to determine the economics involved in steam and electric power generation.

In such studies, these flowsheets are used in calculating heat balances which are prepared for several schemes and several combinations of electric power and steam loads will be considered. This is an example of how flowsheets are used to present essential information to the board of directors and top management when matters of policy are being considered—in this case, the purchase of steam and electric power from utilities, or their generation within the plant, itself.

Each combination is represented on a separate flowsheet. These are skeletonized, showing only the main components of the power plant where heat exchange takes place, such as boilers, turbines, condensers and preheaters. Steam pressures, temperatures and flow, condensate and cooling water temperatures and flow along with power output are also listed.

These heat balances enable top management and engineering management to study the economics, flexibility, capacity, dependability and adaptability to future expansion of the several proposals.

After the selection of a particular scheme, the flowsheets are used in definitive planning to select the system components, develop equipment specifications, develop the flowsheet for the power plant and to prepare the necessary operating manuals.

Electrical Single-line Diagram

The electrical single-line diagram describes all of the elements of the electrical system in the plant, from the power source to the power users with all of the lines and controls on and between them shown in a coded or symbolic manner.

The essential purpose of the diagram is to represent the voltage, frequency, ground connections, component short-circuit capacities, course of power, equipment ratings, metering, relaying, etc., all in electrical shorthand.

Conventional symbols used are standardized by the American Standards Association and are used in conjunction with a standard list of device-function numbers which eliminates wordage. The figure on p. 266 illustrates a typical diagram using these symbols and numbers. It's applied to a typical process plant of which the fractionation unit shown on p. 254 is delineated in detail.

Electrical single-line diagrams should not be confused with the elementary diagram, the schematic wiring diagram, and the equipment interconnection wiring diagram. These are detailed expressions of the over-all "plot" picture of the single-line diagram, as will be explained later. Furthermore, though there are many schemes for distributing and using electric power (simple-primary radial,

looped-primary radial, selective-primary radial, etc.) all of these schemes are represented on only one type of single-line diagram.

The single-line diagram is used in the first, or basic, step of plant electric power planning. Its preparation permits discussion and study of power economics, power source and distribution reliability, continuity and flexibility of the power system, provisions for change and growth, adequacy of delivered power and voltage, and probable system maintenance. In effect, it is the engineer's method of expressing his ideas in order to develop the power scheme desired and most suitable for the particular plant.

Following the selection of the power scheme, the single-line diagram is used in definitive planning to determine and select system components, develop equipment specifications, develop design drawings and general specifications, develop operating manuals, and to prepare a quick reference for over-all plant operation, maintenance, and revamp.

Once the electrical design is fixed in this definitive stage, the diagram and its equipment specifications are sent to the manufacturer for equipment construction. The manufacturer and/or plant engineer will develop the elementary diagram. This will detail the control and relaying schemes, etc. Accompanying this will be a schematic wiring diagram which, symbolically, shows equipment wiring. After concurrence is reached with the plant engineer on these latter details, the manufacturer will proceed with the interconnection wiring diagram. On this drawing is delineated the location of specific wires and terminal blocks, etc., in their respective locations. From these data, the manufacturer can assemble his equipment, and the plant engineer can provide and locate on the construction drawing the termini of his conduits, cables, etc. for easy connection to the equipment when it arrives at the plant site for installation.

After plant construction is completed, these detail diagrams may be filed for future reference as required. But the electrical single-line diagram must be readily accessible to plant engineering and maintenance departments. A quick reference at any time will tell what is installed, how, why and of what characteristic. It is essential to troubleshooting, system modification and other reference, for it is the skeletal X-ray picture of the plant electrical system.

Flowsheets Have But One Use

Without question, flowsheets are indispensable as transmitters of information essential in the design stages. Perhaps this is their most familiar role; but it is neither the alpha nor the omega of their usefulness. In the final analysis, flowsheets do communicate an astonishing amount of engineering information about many things to many groups for a surprising variety of uses.

Certainly, it would be impossible to describe all of the uses of flowsheet information within the limits of this report. These can only be indicated to spur the reader's own thinking as to their full impact.

Here are some examples of how flowsheets transmit engineering information to various line and staff groups:

• Management. Flowsheets are a fertile source of significant economic information. As they are developed in sequence, they progressively bring the pictures of the capital investment required and the operating and production costs clearly into focus. They point up the net earning capabilities of the project.

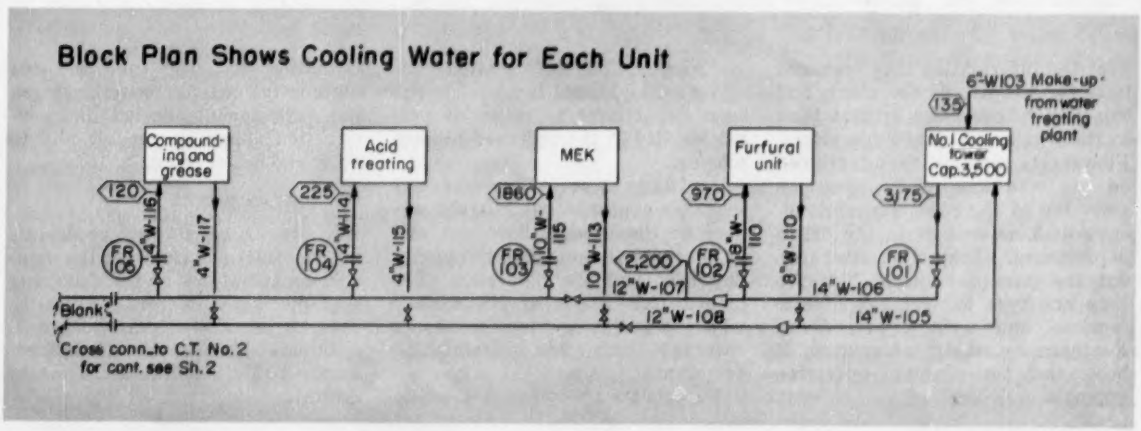
• Research and development. Information contained in the "what and why" flowsheets serves as a continuous check on the process scheme as it evolves from the laboratory and/or pilot-plant operations. Meanwhile, a similar check is provided by the "how" flowsheets as they translate the scheme into full-scaled reality.

• Engineering. Information conveyed by all flowsheets in the sequence becomes the "bible" of the chemical, mechanical, civil and electrical engineering departments.

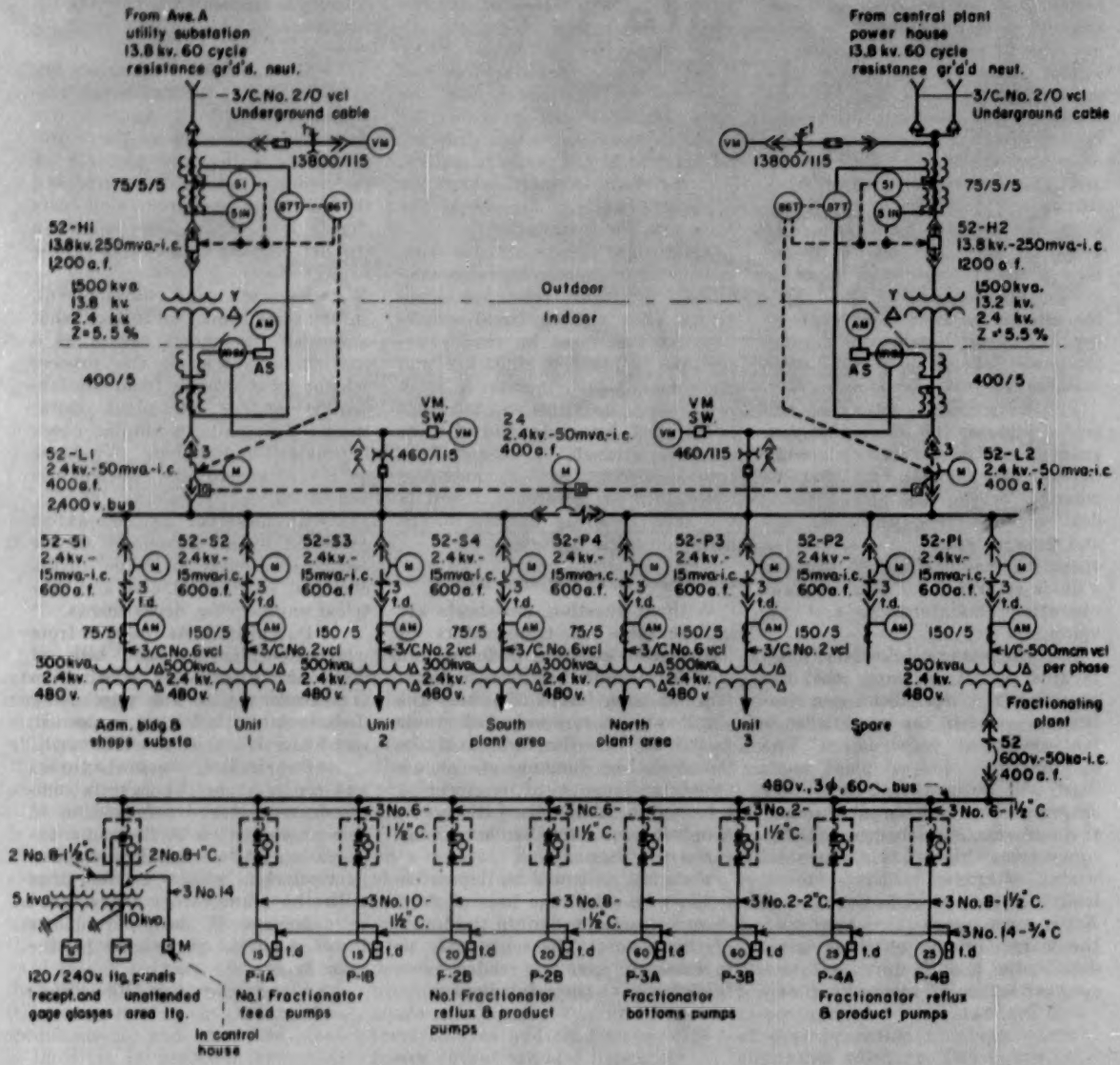
• Purchasing. As the root from which specifications and bills of material are prepared, information is transmitted to the purchasing department to tell what is needed, and when deliveries must be made.

• Fabricators, manufacturers and constructors. Flowsheets communicate essential information to this group for use in their own engineering and design departments, particularly when collaboration with the plant owner is required to solve special design problems imposed by the process or by the plant layout.

• Plant supervision. Flowsheets



Electrical Single-Line Diagram is a First Step



live; the information they transmit lasts for the life of the plant, and this is nowhere more evident than in their value to plant supervisors. Flowsheets will be found framed on the wall and even under the glass top of the plant superintendent's desk as well as in the offices of foremen. They not only spell out the process visually, but also they are keys to operating, maintenance and safety procedures. Furthermore, their information is basic data for all plant operating manuals.

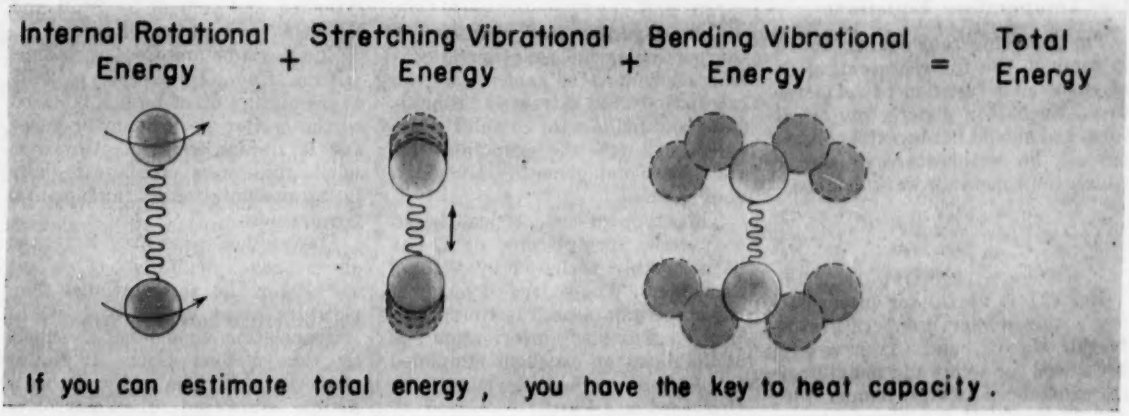
• **Legal.** The information conveyed by flowsheets is useful to the legal department to establish patent legality of the proposed process scheme.

• **Insurance.** The process scheme's exposure hazards will appear in the process flowsheet and be engineered against in the piping flowsheet and the plot plan. The information imparted is required when negotiating for insurance coverage and for establishing premiums.

Flowsheets speed the flow of information to, from and among: engineering management; research and development; design and construction; plant operation; and to sales and purchasing.

ACKNOWLEDGEMENT

In conclusion, the writer desires to gratefully acknowledge the valuable contributions of the following staff members: Messrs. Gordon E. Treman, S. F. Rinaldi, George J. Feinman, James F. Gallagher, James T. McLaughlin, and Herbert Argintar.



Predict Heat Capacities of Gases

Use fundamental vibrational frequencies of bond types to help you in rapidly estimating heat capacities of gases and vapors.

WALLACE R. GAMBILL, Union Carbide Chemicals Co., Charleston, W. Va.*

The heat capacities of gases and vapors are important on a practical basis for calculation of heat transfer and transport. Values generally accurate enough for such engineering purposes may be calculated by the methods described in this article. But as Masi[1] has pointed out, accurate experimental measurements at several pressures and temperatures are valuable in at least two other ways.

First, these measured values may be extrapolated to zero pressure at several temperatures to obtain a set of values of ideal-gas heat capacities. Once a reliable set of molecular constants (vibrational frequencies, etc.) have been calculated from these zero-pressure data, the zero-pressure thermodynamic properties may be calculated over a temperature range far larger than that of the original heat capacity measurements.

Further, the values obtained for the change of heat capacity with pressure may be considerably more accurate than those calculated from data of state of even moderately good accuracy. Existing equations of state may then be checked and modified.

These considerations apply especially to the more complex vapor molecules. For the complex molecules calculation of heat capacity by statistical and other means is more uncertain than for simply structured molecules of the diatomic and triatomic types.

Use Kinetic Theory

Approximate values for gaseous heat capacities are obtainable from the simple kinetic theory. These, along with a few empirical observations, are summarized below. All values of C_p and C_v are on a molar basis. It should be understood that these values are only approximations for real gases and that the specific estimation methods outlined later are preferable for specific cases.

• For monatomic gases C_p is 5 and C_v is 3. At low pressures these values are practically independent of temperature, even for real gases. $K = C_p/C_v$ is 1.67. Eastman[2] reported 4.98 for molar C_p of monatomic metallic vapors (Na, Cd, Hg, etc.).

• For diatomic gases C_p is about 7 and C_v is 5. At low temperatures, the temperature coefficient is small and K is about 1.4.

• For triatomic gases C_p is about 8 with C_v between 6 and 7. Here all values change rapidly with temperature. The K value varies but is about 1.33, theoretically.

• Increasing molecular complexity is paralleled by increasing heat capacity, increased temperature coefficient of heat capacity and decreasing K value. For high molecular weight organic compounds, K attains a value of about 1.1.

Heat Capacity for Ideal Gases

For ideal gases for which $(C_p - C_v) = R$, K may be calculated from

$$K = C_p/(C_p - R) = (C_v + R)/C_v \quad (1)$$

where $K = C_p/C_v$; C_p, C_v = molar heat capacities at constant pressure and volume, respectively; R = molar gas constant.

This relation may be used for real gases at low densities, where the deviation from ideality is small. Simple kinetic considerations predict no temperature or pressure dependence of K. However, the values of K for real gases generally increase with decrease of temperature and/or increase of pressure.

*Mr. Gambill is now with the Union Carbide Nuclear Co., Oak Ridge, Tenn. To meet your author see *Chem. Eng.*, Aug. 1957, p. 329.

Use Temperature Equations

The following four equations are in common use for representing C_p of gases as a function of temperature. Each is a strictly empirical form and should not be extrapolated beyond the temperature range for which the constants were derived.

$$C_p = a + bt + ct^2 \quad (2)$$
$$C_p = a + bt - c/t^2 \quad (3)$$
$$C_p = a + bt + c/t^{0.5} \quad (4)$$
$$C_p = a + bt + ct^2 + dt^3 \quad (5)$$

Eq. (2) is useful for interpolating within a short temperature interval. Eq. (3) and (4) have also been used for solids and metallurgical substances at high temperature and fit poorly at low temperatures. Eq. (5) is the best general choice and was selected by Kobe, et al[4]; only six compounds out of about 100 studied failed to fit this equation with a maximum error of less than ± 1%.

For different gases, however, there is no one empirical form which is always superior. Detailed consideration of the temperature dependence of C_p of gases may be found in two articles by Spencer[4, 5].

Exact Method for Heat Capacity

The most exact calculation of gaseous heat capacities are made from statistical mechanical theory. The method uses information concerning the distribution of the various types of energy within the molecule. The information has been deduced from the infrared and Raman spectra.

The drawbacks of this quite accurate and rigorous approach are: (a) the fundamental frequencies of the particular molecule under consideration must be known, (b) the calculation is extremely complicated and tedious for complex molecules and (c) the principles involved are not generally known to engineers.

This type of calculation, based on specific spectroscopic data, has been capably reviewed by Wilson[6] and others. The source of much of the spectra data used is Herzberg's book[7]. Further information is available in an excellent simplified calculation method developed by Crawford and Parr[8].

Simpler Method for Speed

Fortunately, a simpler but still accurate method has been developed through the concept that a particular type of bond possesses two characteristics fundamental vibrational frequencies. These are independent of the nature of the molecule in which the bond occurs.

The stretching or valence vibration acts along the bond at high rate and the bending or deformation vibration acts at right angles to the bond at a lower frequency. Average values of these frequencies can be generalized for various types of common bondings with an accuracy sufficient for engineering needs.

The general procedure was originated by Bennewitz and Rossner[9], simplified by Fugasi and Rudy[10], modified by Dobratz[11], and further extended and refined by Stull and Mayfield[12] and Meghreblian[13].

The Sakiadis and Coates' method (*Chem. Eng.*, July 1957, p. 263) of calculating C_p of liquids is based on the earlier work done for gases and is similar in form. However, some differences exist—especially in the presentation of fundamental frequencies.

The method presented here has an average deviation of about ± 4% for the recommended temperature range of 250 to 1,100 K. Extrapolation should not be made by this method below 200K. or above 1,500 K. The earlier Dobratz article[11] covered the narrower range of 300 to 700 K.

The values of the Einstein functions at different temperatures corresponding to the assigned frequencies were fitted to equations of the form $C_i = a + bT + cT^2$. As a result a single calculation would give an equation for C_p as a function of temperature.

The later work[13] extended the upper temperature limit to 1,500 K. Since electron interaction develops within some molecules for temperatures greater than 1,100 K., calculated values will tend to be too low above this temperature.

How to Find Molar Heat Capacity

The complete expression for molar heat capacity at constant (zero) pressure is given by Eq. (6). In this equation the significant internal rotational energy n_r' is believed to result only from the rotation of groups of atoms—not single atoms—about single valence bonds. The cases usually met are C-C, C-O in ethers and esters and O-O bonds.

The fundamental frequencies of various bonds expressed in wave

Equation for Molar Heat Capacity:

$$C_p^\circ = 4R + n_r'(R/2) + \Sigma_i q_i c_{v_i} + \left[\frac{3n - 6 - n_r' - \Sigma q_i}{\Sigma q_i}\right] \Sigma q_i c_{\delta_i} \quad (6)$$

Calculate Heat Capacities From Bond Frequencies, Table I

Bond	Stretching ω_s'	Deformation ω_δ'	Bond	Stretching ω_s'	Deformation ω_δ'
C—H (aliphatic)	2,914	1,247	C=S	1,050	530
C—C (aliphatic)	989	390	S—S	500	260
C=C (aliphatic sym.)	1,618	599	S—H	2,570	1,050
C=C (aliphatic unsym.)	1,664	421	C—N	990	390
C≡C (aliphatic)	2,215	333	C=N	1,620	845
C—H (aromatic)	3,045	1,318	N—N	990	390
C—C (aromatic)	989	390	N—H	2,920	1,320
C=C (aromatic)	1,618	844	N—O	1,030	205
C—I	500	260	N=O	1,700	390
C—Br	560	280	C—O	1,030	205
C—Cl	650	330	C=O	1,700	390
C—F	1,050	530	O—H	3,420	1,150
C—S	650	330			

Nomenclature

R	Molar gas constant, 1.987 Btu./lb. mole-deg. Rankine
Σq_i	Total number of bonds in the molecule
c_{v_i}	Contribution to the heat capacity from the stretching vibrations of bond i
c_{δ_i}	Contribution to the heat capacity from the bending of bond i
n	Number of atoms in the molecule
n_r'	Number of single bonds about which internal rotation of groups can take place

numbers are given in Table I. The frequency assignment for the C-C bond is based on the higher or substituted acetylenes. Therefore, the frequency is not too accurate for acetylene itself.

The C-C and C-H bonds are classified according to their aliphatic or aromatic, symmetrical or unsymmetrical nature. This classification is unlike the Sakiadis and Coates method[14] for the heat capacity of liquids. Eq. (6) may be evaluated by a summation of the stretching and bending contributions corresponding to the various fundamental bond frequencies at a selected temperature.

These contributions are obtained from Table II[15], where T = K. A graph showing these contributions as a function of wave number and temperature is also available[16].

Example Illustrates Method

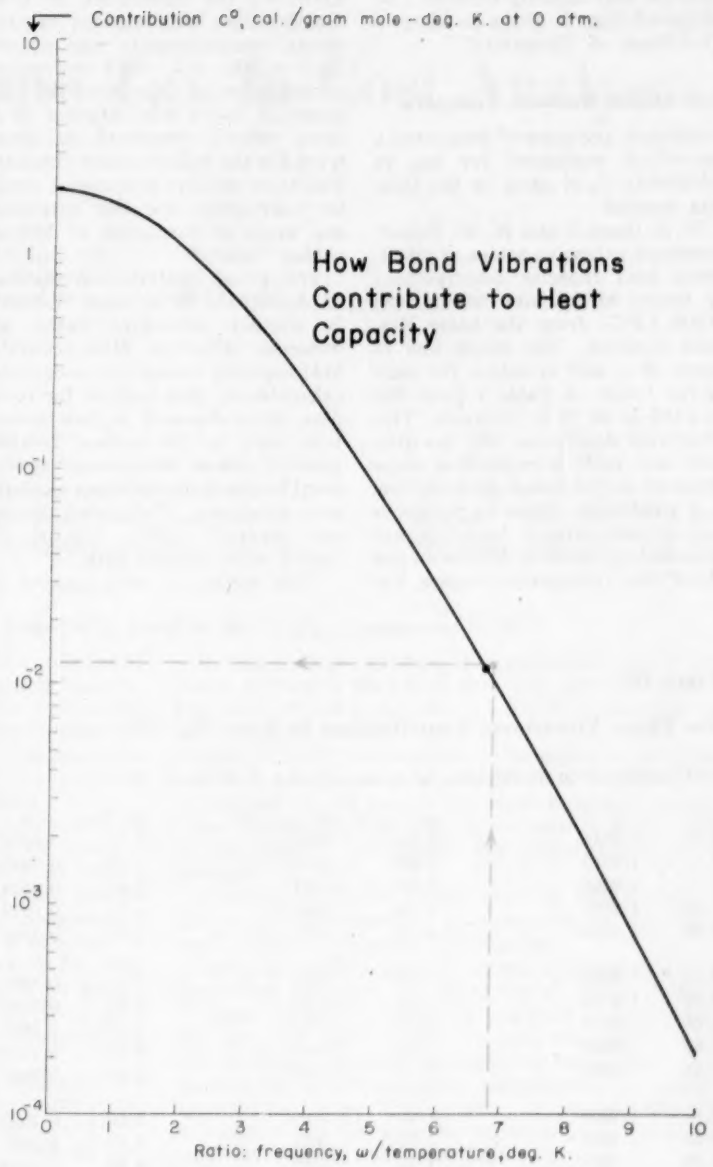
In an adjoining column, an example is described for the associated and polar compound ethanol. In solving Eq. (6), the various terms are obtained as follows: the fundamental bond frequencies from Table I; the terms $q_i c_{vi}$ and $q_i c_{si}$ are the product of the number q_i of the particular bond types in the molecule and c_{vi} or c_{si}. These values are obtained from Table II by dividing the corresponding ω_v or ω_s by the temperature 434 K. and extracting the proper c° value.

Additional Factors to Consider

We treat naphthenic ring bondings as aromatic. Further, this method will not distinguish between some isomeric structures. However, differences between isomer heat capacities is usually small. Also, the deviations for methane and ethane are somewhat greater than for higher homologs.

Finally, most aliphatic carboxylic acids and probably the aromatic ones also, associate in the vapor state to form polymeric molecules. The calculation should be made accordingly. It may be shown that the calculation may be made for a single molecule. The resulting heat capacity C_p is then directly multiplied by the appropriate number (two for dimers, etc.).

For acetic acid vapor at 160 C. and one atmosphere absolute, the calculation indicates 3½ moles for the complex molecule. This result



Example: Find Heat Capacity of Ethanol Vapor at 434 K. and 0 atm.

Bond	q_i	w_v'	w_s'	$q_i c_{vi}$	$q_i c_{si}$
C-H	5	2,914	1,247	0.0585	2.8040
C-C	1	989	390	1.1343	1.7312
C-O	1	1,030	205	0.8135	1.9119
O-H	1	3,420	1,150	0.0030	0.6675
	8			2.0093	7.1146

$n = 9$, $n_r' = 1$, $R = 1.987$, $\Sigma q_i = 8$

$$C_p^\circ = 4(1.987) + 1\left(\frac{1.987}{2}\right) + 2.009 + \left(\frac{27-6-1-8}{8}\right)(7.115)$$

C_p° (Calculated) = 21.642 cal./gram mole-deg. K. or 0.470 Btu./lb.-deg. R.
C_p° (Experimental)[3] = 0.461; deviation = 1.8%

is obtained when working back from the heat capacity value of 1.27 cal./gram-deg. C. given in Lange's "Handbook of Chemistry".[17]

How Other Methods Compare

Johnson and others[18] presented a convenient worksheet for use in calculating C_p of gases by the Dobratz method.

W. R. Gambill and W. W. Baker[19] developed extensive tables of vibrational heat capacity contributions by means of machine calculations (IBM CPC) from the basic Einstein function. The result was 18 pages of c_v and c_s values for each of the bonds of Table I from 250 to 1,100 K. at 10 K. intervals. This effectively does away with the division and table interpolation steps involved in the above presentation.

A treatment similar to the above and of even higher accuracy was proposed by Souders, Matthews and Hurd[20] for hydrocarbon vapors. For the temperature range of -250 to 3,000 F., the agreement of predicted values with modern experimental measurements was generally within 3%. The increased accuracy beyond the more general approach above was obtained by a more refined treatment of bond types for the hydrocarbons checked. The same authors proposed a similar correlation for the entropies and heats of formation of hydrocarbon vapors[21].

The group contribution method of Anderson, Beyer and Watson[22] is another procedure based on molecular structure. More accurate heat capacity values are sometimes calculable by this method for complex molecules and higher homologs than by the method treated directly above. The poorest agreement has been for tertiary alcohols and aldehydes. Calculated values are generally within 5% of accepted experimental data.

This method is well treated in the references[23, 24] which give a considerable number of tables. These tables include values for estimating entropies and heats of formation of organic vapors as well as their heat capacities.

Barrow[24] proposed an interesting method of calculating vapor heat capacities. He used liquid heat capacities and the heat capacity difference (C_p vap. $-C_p$ liq.) calculated from the Frost vapor pressure equation. The average error for the 12 vapors tested including nine organic compounds was 2.7%. The considerable amount of data required by the method reduces its engineering utility.

TABLE II*

Use These Vibrational Contributions to Solve Eq. (6)

c^o = Contribution to specific heat, cal./gram mole-deg. K. at 0 atm.

ω'/T	c^o	ω'/T	c^o	ω'/T	c^o
0.10	1.9834	0.95	1.7045	2.40	0.8000
0.12	1.9819	1.00	1.6770	2.50	0.7453
0.14	1.9801	1.05	1.6487	2.60	0.6928
0.16	1.9780	1.10	1.6196	2.70	0.6429
0.18	1.9756	1.15	1.5897	2.80	0.5953
0.20	1.9731	1.20	1.5592	2.90	0.5502
0.22	1.9703	1.25	1.5281	3.00	0.5080
0.24	1.9671	1.30	1.4966	3.10	0.4680
0.26	1.9638	1.35	1.4646	3.20	0.4305
0.28	1.9601	1.40	1.4324	3.40	0.3627
0.30	1.9563	1.45	1.3999	3.50	0.3323
0.32	1.9521	1.50	1.3671	3.75	0.2651
0.34	1.9478	1.55	1.3340	4.00	0.2099
0.36	1.9430	1.60	1.3010	4.50	0.1286
0.40	1.9330	1.65	1.2680	5.00	0.0775
0.45	1.9188	1.70	1.2349	5.50	0.0454
0.50	1.9033	1.75	1.2018	6.00	0.0265
0.55	1.8863	1.80	1.1690	6.50	0.0151
0.60	1.8680	1.85	1.1363	7.00	0.00852
0.65	1.8481	1.90	1.1038	7.50	0.00474
0.70	1.8272	1.95	1.0716	8.00	0.00265
0.75	1.8047	2.00	1.0398	8.50	0.00145
0.80	1.7813	2.10	0.9772	9.00	0.000792
0.85	1.7568	2.20	0.9161	9.50	0.000431
0.90	1.7312	2.30	0.8570	10.00	0.000232

* Abridged from Taylor and Glasstone.[15]

REFERENCES

1. Masi, J. F., "Survey of Experimental Determinations of Heat Capacity of Ten Technically Important Gases", *ASME Preprint No. 53-A-206*, presented at Annual ASME meeting, N. Y., Dec. 1953.
2. Eastman, E. D., Bureau of Mines *Technical Paper No. 445*, 1929.
3. Kobe, K. A., and Associates, "Thermochemistry for the Petrochemical Industry", *Pet. Refiner*, 19 parts, Jan. 1949 through Dec. 1951.
4. Spencer, H. M., "Temperature Dependence of the Heat Capacity of Gases", *J. Chem. Phys.*, **25**, 357 (1956).
5. Spencer, H. M. *I.E.C.*, **40**, 2152-54 (1948).
6. Wilson, E. B., "Present Status of the Statistical Method of Calculating Thermodynamic Functions", *Chem. Rev.*, **27**, 17-38 (1940).
7. Herzberg, G., "Infra-Red and Raman Spectra of Polyatomic Molecules", D. Van Nostrand, N. Y., 1945.
8. Crawford, B. L., Jr. and R. G. Parr, "Simple Expressions for the Heat Capacities of Gases", *J. of Chem. Phys.*, **16**, 233-36 (1948).
9. Bennewitz, K. and W. Rossner, *Z. Phys. Chem.*, **39B**, 126 (1938).
10. Fugassi, P. and C. E. Rudy, *I.E.C.*, **30**, 1029 (1938).
11. Dobratz, C. J., "Heat Capacities of Organic Vapors", *I.E.C.*, **33**, 759, (1941).
12. Stull, D. R. and F. D. Mayfield, "Heat Capacities of Hydrocarbon Gases", *I.E.C.*, **35**, 639-45, 1303-04 (1943).
13. Meghreblian, R. V., "Approximate Calculation of Specific Heats for Polyatomic Gases", *J. Amer. Rocket Soc.* **21**, 127-31 (1951).
14. Gambill, W. R., Predict Liquid Heat Capacities", *Chem. Eng.* July 1957, p. 263.
15. Schumann, S. C. and M. L. Schwartz; H. Taylor and S. Glasstone, "Treatise on Physical Chemistry", Vol. I, D. Van Nostrand Co., N. Y., 1942.
16. Hougen, O. A. and K. M. Watson, "Chemical Process Principles Charts", Fig. 166, John Wiley & Sons, Inc., N. Y. 1946.
17. Lange, N. A., "Handbook of Chemistry", 7th Edition, p. 1515, Handbook Publishing Inc., Sandusky, Ohio, 1949.
18. Johnson, A. I., C. J. Huang and R. D. Higgins, "Process Design Data—Part II", *Chemistry in Canada*, June 1954, p. 31.
19. Engineering Dept., Carbide and Carbon Chemicals Co., 1955.
20. Souders, M., Jr., C. S. Matthews and C. O. Hurd, "Relationship of Thermodynamic Properties to Molecular Structure", *I.E.C.*, **41**, 1037-48 (1949).
21. Souders, M., Jr., C. S. Matthews and C. O. Hurd, "Relationship of Thermodynamic Properties to Molecular Structure", *I.E.C.* **41**, 1048-56 (1949).
22. Andersen, J. W., G. H. Beyer and K. M. Watson, *National Petroleum News, Tech. Sec.*, **36**, R476 (1944).
23. Hougen, O. A. and K. M. Watson, "Chemical Process Principles", Part II, pp. 758-65, John Wiley & Sons, Inc., N. Y. 1947.
24. Barrow, G. M., *The J. of Chem. Physics*, **21**, No. 11, 1912-12 (1953).

Consider Income Tax in Cost Analyses

When you buy,
don't forget the effect of income tax on
how much you can afford to spend for an article and
how long a life it should have.

Tax rate	**0**	**52%**	**0**
Interest rate after taxes	**8%**	**8%**	**16.67%**
Interest rate before taxes	**8%**	**16.67%**	**16.67%**
Equivalent cost, one year life	**$10,000**	**$10,000**	**$10,000**
Equivalent cost, ten year life	**$72,460**	**$61,470**	**$55,020**

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The cost of supporting the government comes high; we cannot ignore taxes. In an earlier article[1] we presented a method for making comparative cost analyses based on capitalized cost, but we didn't consider taxes. Since comparisons should be based on costs after taxes we'll now extend the concept of capitalized cost in this article to include income taxes.

Income tax is peculiar because it applies only to profits and is influenced by the manner in which a capital expense is depreciated for tax purposes. Other taxes need no special attention because they can be handled in the same manner as ordinary expenses.

Currently the federal income tax for a company is 52% for all profits over $25,000 per year. In some localities a state income tax will have to be added. For the purpose of illustration, we'll use an income tax rate of 52% but the equations will accommodate any rate.

The term capitalized cost is used to designate the first cost plus the present value of an indefinite number of renewals. It is the cost on a perpetual basis, or the cost if the article or process were in use forever.

We can illustrate the full significance of this concept by a simple numerical example as follows:

Condenser tubes cost $10,000 installed and last six years. Assume solely for the purpose of this article that money is worth 8%. Capitalized cost of the tubes is $27,040, as the following reasoning will verify. The capitalized cost of $27,040 less the original cost of $10,000 leaves $17,040 in excess. This $17,040 at 8% compound interest for six years will equal $27,040, so that at the end of six years when the tubes must be replaced we will have available $10,000 for the replacement plus $17,040 left over, which in turn will equal $27,040 at the end of another six years.

* Meet your author on page 342.

In this example $27,040, the capitalized cost of the tubes, is exactly that sum that will provide for the first cost of the tubes plus an indefinite number of renewals.

Even if the tubes were not to be perpetuated (suppose they were part of a process which is abandoned at the end of six years) the capitalized cost of the tubes is still $27,040. This is so because at the end of the life of the tubes, the capitalized cost is restored.

In other words, we do not mean to imply that an article will be replaced in kind forever, but use "forever" only as a common denominator.

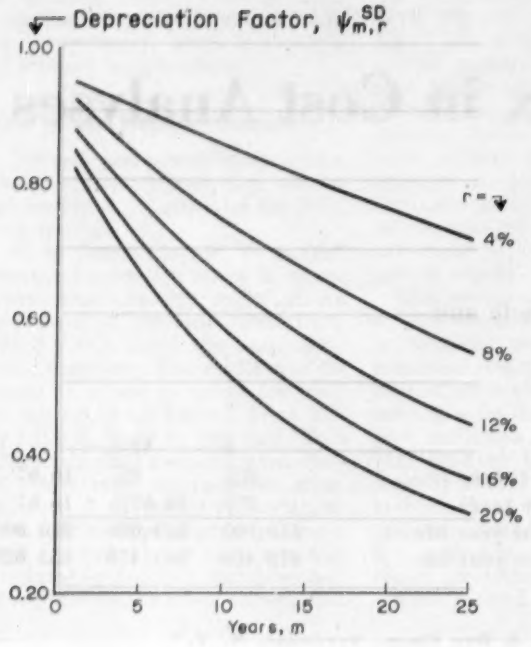
As an illustration, the table of equivalent costs above shows how much we can afford for an article lasting ten years if an article lasting one year costs $10,000. The first and second cases are both calculated on an 8% net return whether income taxes exist or not. We see that the second condition, with income tax, works against the longer lived article. It permits $61,470 to be spent for the ten-year period while without income tax $72,460 could be spent.

This comparison corresponds to the normal tendency for the net return on investment to approach the same figure independent of the income tax, within limits.

The second and third conditions have the same return on investment before taxes but different net returns after taxes. Under these circumstances, the effect of income tax is to favor the longer lived article. Without taxes, only $55,020 could be justified for the ten-year article while with income tax up to $61,470 could be justified.

Taxes Affect Interest Rate

One effect introduced by income tax is a reduction in the rate of return or the interest rate. If i is the



Use These Factors for the Problems

$$I_{m,r} = (1+r)^m \qquad F_{m,r} = 1 + G_{m,r}$$

$$G_{m,r} = 1/[(1+r)^m - 1]$$

$$\psi_{m,r}^{SD} = \left(\frac{G_{1,r}}{0.5m(m+1)}\right) \times \left(m - \frac{G_{1,r}}{F_{m,r}}\right)$$

m	$I_{m,8\%}$	$G_{m,8\%}$	$F_{m,8\%}$	$\psi_{m,8\%}^{SD}$	$(1-0.52\ \psi_{m,8\%}^{SD})$
1	1.0800	12.50	13.50	0.9259	0.5185
2	1.1664	6.010	7.010	0.9035	0.5302
3	1.2597	3.851	4.851	0.8817	0.5415
4	1.3605	2.774	3.774	0.8598	0.5529
5	1.4693	2.131	3.131	0.8397	0.5634
10	2.1589	0.8629	1.863	0.7477	0.6112

rate of return before taxes, t the income tax rate and r is the return on investment after taxes, all expressed as a decimal per year, then:

$$r = i(1-t) \qquad (1)$$

If money compounds at an interest rate i before taxes, it will compound at a rate r after taxes. The equations in this article are expressed in terms of r.

Depreciation Is Important

When we spend an amount M at the beginning of the year for something which can be depreciated in full during the year, such as a maintenance expense, we also reduce our profit for the year and receive a tax credit at the end of the year.

The net cost after taxes referred to the beginning of the year is:

$$M[1 - t/(1+r)] \qquad (2)$$

Eq. (2) is easily derived. A cost of M before taxes at the beginning of the year is equivalent to a cost of $M\ (1+i)$ at the end of the year before taxes. A savings of $tM\ (1+i)$ is made at the end of the year from tax reduction, leaving a net after taxes of:

$$M[(1+r) - t] \qquad (3)$$

Eq. (3) is the amount after taxes and is brought back to the beginning of the year by multiplying by $1/(1+r)$ resulting in Eq. 2.

Under existing laws, income taxes are paid in part in the current year and in part in the succeeding year. For our purpose it seems adequate to consider them to be paid in one sum at the end of the year.

When we purchase an article lasting m years we depreciate it over the life of the article by some formula acceptable to the government. One acceptable method is the so called sum-of-the-digits.[3] Suppose an article lasts four years, then the sum-of-the-digits is obtained by adding the numbers representing the years of useful life, $4 + 3 + 2 + 1 = 10$, or algebraically for an m year life: $0.5m(m+1)$. The sum is the denominator and the number of useful years remaining is the numerator. The fraction obtained is multiplied by the original cost each year and results in a depreciated value for that given year.

The depreciation allowed for the first year expressed as a fraction is: $m/[0.5m(m+1)]$. For the second year: $(m-1)/[0.5m(m+1)]$. Down to: $1/[0.5m(m+1)]$ for the last year. Algebraically for the x-th year the fraction is:

$$[(m+1) - x]/[0.5m(m+1)]$$

Since the sum-of-the-digits methods is an easy and acceptable way to take depreciation our equations and examples are based on this method. Later in this article we'll show how other depreciation methods are used.

Suppose an article lasts m years and we let the symbol C_d stand for that part of the first cost which can be depreciated. The first cost minus the salvage value is C_d. Later we shall show how to include this salvage value. The present value of C_d less its tax credits from depreciation is:

$$C_d - tC_d \sum_{x=1}^{x=m} \frac{(m+1) - x}{0.5m(m+1)} \times \frac{1}{(1+r)^x} \qquad (4)$$

Regardless of the method used for depreciation, Eq. (4) will take the form:

$$C_d(1 - t\psi_{m,r}) \qquad (5)$$

while specifically for the sum-of-the-digits depreciation:

$$\psi_{m,r}^{SD} = \left(\frac{G_{1,r}}{0.5m(m+1)}\right) \times \left(m - \frac{G_{1,r}}{F_{m,r}}\right) \qquad (6)$$

and

$$G_{m,r} = 1/[(1+r)^m - 1]$$

$$F_{m,r} = (1+r)^m/[(1+r)^m - 1] = 1 + G_{m,r}$$

The ψ factor depends on the depreciation method used. Identification of the sum-of-the-digits method is by

the superscript *SD*. A plot for the evaluation of $\psi_{m,r}^{SD}$ is shown on the left. Tables for *F* and *G* factors were given earlier.[2] For convenience, selected values of various factors are given. These can be used in checking the numerical examples of this article. We also include the value of: $(1 - 0.52\psi_{m,r}^{SD})$.

For the Initial Cost

After taxes, the present value for the cost C_d of an article lasting m years is given by Eq. (5). Before we can use it in comparison with another article having a different service life we must convert it to some form embracing a common denominator for all service lives. Capitalized cost uses infinity for the common denominator. From the discussion in the earlier article we know that multiplying Eq. (5) by $F_{m,r}$ converts it to a capitalized cost, giving:

$$K_t = C_d F_{m,r}(1 - t\psi_{m,r}) \qquad (7)$$

where K_t is the capitalized cost after taxes.

Problem—A tank costs $10,000 and lasts two years. Money is worth 8% per year after taxes and the income tax rate is 52%. How much can be spent for a tank that lasts five years?

Solution—By Eq. (7), K_t for the two-year tank is:

$$\begin{aligned} K_t &= (10{,}000)(F_{2.8\%})(1 - 0.52\psi_{2.8\%}) \\ &= (10{,}000)(7.010)(0.5302) \\ &= \$37{,}170 \end{aligned}$$

For the same K_t for the five-year tank:

$$\begin{aligned} 37{,}170 &= C_d F_{5.8\%}(1 - 0.52\psi_{5.8\%}) \\ 37{,}170 &= C_d(3.131)(0.5634) \\ C_d &= \$21{,}070 \end{aligned}$$

That is, up to $21,070 could be spent for a tank.

With Uniform Yearly Expenses

If we have a uniform yearly expense M at the beginning of the year and occurring every year, the capitalized cost is obtained by placing $m = 1$ in Eq. (7), giving:

$$K_t = MF_{1,r}(1 - t\psi_{1,r}) \qquad (8)$$

where $\psi_{1,r} = 1/(1 + r)$.

Problem—A tank costs $10,000 and lasts two years. Money is worth 8% per year after taxes and the income tax rate is 52%. How much can be spent at the beginning of every year for lining the tank so as to to get five years life?

Solution—In the solution that follows the lined tank is depreciated over a five year life.

For the unlined tank we have by Eq. (7):

$$\begin{aligned} K_t &= (10{,}000)(F_{2.8\%})(1 - 0.52\psi_{2.8\%}) \\ &= (10{,}000)(7.010)(0.5302) \\ &= \$37{,}170 \end{aligned}$$

Capitalized cost of the lined tank must not exceed this and is obtained by combining Eqs. (7) and (8).

$$\begin{aligned} 37{,}170 &= (10{,}000)(F_{5.8\%})(1 - 0.52\psi_{5.8\%}) + MF_{1.8\%}(1 - 0.52\psi_{1.8\%}) \\ 37{,}170 &= (10{,}000)(3.131)(0.5634) + M(13.50)(0.5185) \\ M &= \$2{,}790 \end{aligned}$$

That is, up to $2,790 could be spent at the beginning of each of the five years.

With Irregular Yearly Expenses

Only if the yearly expense is uniform and occurs every year is Eq. (8) suitable. We need a more general equation if the expense is irregular.

If an article lasts m years and incurs an expense B_x at the beginning of the x-th year, which can be fully depreciated in one year, the capitalized cost of the expense B_x is:

$$K_t = [B_x F_{m,r}/I_{(x-1),r}][1 - t\psi_{1,r}] \qquad (9)$$

where $I_{m,r} = (1 + r)^m$

Or, for all years:

$$K_t = F_{m,r}(1 - t\psi_{1,r}) \sum_{x=1}^{x=m} B_x/I_{(x-1),r} \qquad (10)$$

Eq. (10) will accommodate all yearly expenses however irregular they may be.

What About Salvage Value?

Generally speaking, salvage value in chemical engineering processes is a very minor fraction of the first cost and can usually be ignored. However, this is not true in all engineering studies and as a chemical engineer you'll occasionally want the relationships necessary for including salvage value.

Suppose an item costs $115,000 and will have a salvage value of $15,000. One purchase is for $100,000 which can be depreciated in full. Capitalized cost of this purchase is given by Eq. (7) where as previously mentioned the symbol C_d is that part of the first cost that can be depreciated.

The part that cannot be depreciated is the second purchase for $15,000 since it will be recovered in full as salvage value. This value will have no effect on profit or loss for any of the years concerned and the capitalized cost will not include the tax rate. We find the capitalized cost by computing the capitalized cost

Nomenclature

B'_x	Yearly expense end of x-th year, dollars.
B_x	Yearly expense beginning of x-th year, dollars.
C_d	Initial cost of facility minus salvage value, dollars.
C_w	Working capital, dollars.
$F_{m,r}$	$1 + G_{m,r}$
$G_{m,r}$	$1/[(1 + r)^m - 1]$
i	Interest rate before taxes, decimal per year.
$I_{m,r}$	$(1 + r)^m$
k_t	Equivalent uniform yearly cost after taxes, dollars per year.
K_t	Capitalized cost after taxes, dollars.
L	Salvage value, dollars.
m	Useful life of a plant, years.
m'	Fast write-off time, years.
M	Uniform yearly expense beginning of year, dollars per year.
M'	Uniform yearly expense end of year, dollars per year.
N	Non-depreciable expense, dollars.
r	Interest rate after taxes, decimal per year.
t	Income tax rate, decimal.
x	The x-th year.
SD	Sum-of-the-digits method of depreciation.
SL	Straight-line method of depreciation.
$\psi_{m,r}$	Factor associated with depreciation.

of investing the salvage value L at the beginning of the life of the article and subtracting from it the capitalized cost of recovering the salvage value L at the end of the life of the article. This comes out simply as:

$$K_t = L \tag{11}$$

If Nonrecurring Costs Occur

If an item lasts forever, or what amounts to the same thing is such that it does not depreciate, the capitalized cost is obtained from Eq. (7), placing $m = \infty$ and noting that $F_{inf\infty,r} = 1$ and $\psi_{inf\infty,r} = 0$. For this case:

$$K_t = N \tag{12}$$

where N is a cost which does not depreciate. Land on which a plant is built will fall in this category unless it can be depleted, such as a mining property. Working capital can also be handled with Eq. (12).

An Extensive Example

How various costs can be treated in one problem is demonstrated below.

Problem—A heat exchanger uses steel tubes that cost \$10,000 and last four years with a \$2,000 salvage value. Cost for cleaning the tubes is \$3,000 per year. At the beginning of the third year the outside of the tubes must be cleaned at a cost of \$4,000. During the fourth year there is an expense of \$1,500.

It's proposed to substitute alloy tubes that cost \$95,000, last ten years and have a \$20,000 salvage value. Maintenance for the alloy tubes is \$1,000 per year and the savings from increased production are \$6,000 per year giving a net expense of minus \$5,000 per year. Money is worth 8% per year after taxes and the income tax rate is 52%.

Does it pay to install the alloy tubes?

Solution—Capitalized cost of the steel tubes is obtained from Eqs. (7), (11), (8) and (10) twice, in order.

$$\begin{aligned}
(10{,}000 - 2{,}000)(F_{4.8\%})(1 - 0.52\psi_{4.8\%}) &= \\
(8{,}000)(3.774)(0.5529) &= 16{,}693 \\
(2{,}000)(1) &= 2{,}000 \\
(3{,}000)(F_{1.8\%})(1 - 0.52\psi_{1.8\%}) &= \\
(3{,}000)(13.5)(0.5185) &= 21{,}000 \\
(4{,}000)(F_{4.8\%}/I_{3.8\%})(1 - 0.52\psi_{1.8\%}) &= \\
(4{,}000)(3.774/1.1664)(0.5185) &= 6{,}711 \\
(1{,}500)(F_{4.8\%}/I_{5.8\%})(1 - 0.52\psi_{1.8\%}) &= \\
(1{,}500)(3.774/1.2597)(0.5185) &= 2{,}330 \\
K_t &= \$48{,}734
\end{aligned}$$

Capitalized cost of the alloy tubes is obtained from Eqs. (7), (11) and (8), in order.

$$\begin{aligned}
(95{,}000 - 20{,}000)(F_{10.8\%})(1 - 0.52\psi_{10.8\%}) &= \\
(75{,}000)(1.863)(0.6112) &= 85{,}400 \\
(20{,}000)(1) &= 20{,}000 \\
(-5{,}000)(F_{1.8\%})(1 - 0.52\psi_{1.8\%}) &= \\
(-5{,}000)(13.5)(0.5185) &= -35{,}000 \\
K_t &= \$70{,}400
\end{aligned}$$

It will not pay to substitute alloy tubes, capitalized cost of \$70,400 against a cost of \$48,734 for the steel tubes in this case.

The Equivalent Yearly Cost

Capitalized cost represents the cost on a perpetual basis, therefore multiplication by the interest rate gives a yearly cost. We have:

$$k_t = rK_t \tag{13}$$

where k_t is the equivalent uniform yearly cost as of the end of the year. Its significance when taxes are considered is explained by the following example.

Problem—An item costs \$10,000 and lasts four years. Money is worth 8% per year after taxes and the income tax rate is 52%. Calculate the equivalent uniform yearly cost k_t and show that it will exactly repay the initial cost with interest.

Soluton—From Eq. (7):

$$\begin{aligned}
K_t &= (10{,}000)(F_{4.8\%})(1 - 0.52\psi_{4.8\%}) \\
&= (10{,}000)(3.774)(0.5529) \\
&= \$20{,}866
\end{aligned}$$

And by Eq. (13): $k_t = (0.08)\ (20{,}866) = \$1{,}669$

By the end of the fourth year the \$1,669 each year will amount to \$7,522 after taxes. The calculation and addition is as follows:

$$\begin{aligned}
(1{,}669)(1.08)^3 &= 2{,}103 \\
(1{,}669)(1.08)^2 &= 1{,}947 \\
(1{,}669)(1.08)^1 &= 1{,}803 \\
(1{,}669)(1.08)^0 &= 1{,}669 \\
&\$7{,}522
\end{aligned}$$

The value of the tax credits from the depreciation will amount to \$6,083 after taxes at the end of the fourth year.

$$\begin{aligned}
(10{,}000)(4/10)(0.52)(1.08)^3 &= 2{,}620 \\
(10{,}000)(3/10)(0.52)(1.08)^2 &= 1{,}820 \\
(10{,}000)(2/10)(0.52)(1.08)^1 &= 1{,}123 \\
(10{,}000)(1/10)(0.52)(1.08)^0 &= 520 \\
&\$6{,}083
\end{aligned}$$

The total available after taxes at the end of the fourth year is \$7,522 + \$6,083 = \$13,605. The original investment amounts to $(10{,}000)\ (1.08)^4 = \$13{,}605$ after taxes at the end of the fourth year.

In the Case of a Fast Write-Off

If a plant lasting m years is allowed a fast write-off in m' years the only factor that must be altered in Eq. (7) is the ψ factor. The years after m' do not contribute to the tax credit because there is nothing left to write off after m' years. Eq. (7) becomes:

$$K_t = C_d F_{m,r}(1 - t\psi_{m',r}) \tag{14}$$

Problem—A plant costing \$1,000,000 will last ten years but has a government certificate of necessity permitting writing off the entire investment in five years. Money is worth 8% per year after taxes and the income tax rate is 52%. Express the savings due to the fast write-off as a present value.

When Applying Capitalized Cost to an Entire Venture Use These Equations

Capitalized Cost with Beginning-of-the-Year Yearly Expenses:

$$K_t = C_d F_{m,r}(1 - t\psi_{m',r}) + F_{m,r}(1 - t\psi_{1,r}) \sum_{x=1}^{x=m} B_x/I_{(x-1),r} + C_w + L \tag{17}$$

Capitalized Cost with End-of-the-Year Yearly Expenses:

$$K_t = C_d F_{m,r}(1 - t\psi_{m',r}) + F_{m,r}(1 - t) \sum_{x=1}^{x=m} B'_x/I_{x,r} + C_w + L \tag{18}$$

Solution—For the normal ten year write-off:

$$\begin{aligned} K_t &= (1{,}000{,}000)(F_{10.8\%})(1 - 0.52\psi_{10.8\%}) \\ &= (1{,}000{,}000)(1.863)(0.6112) \\ &= \$1{,}138{,}600 \end{aligned}$$

For a five year write-off:

$$\begin{aligned} K_t &= (1{,}000{,}000)(F_{10.8\%})(1 - 0.52\psi_{5.8\%}) \\ &= (1{,}000{,}000)(1.863)(0.5634)) \\ &= \$1{,}049{,}600 \end{aligned}$$

The advantage expressed as a capitalized cost is \$1,138,600 − 1,049,600 = \$89,000. This is capitalized on a perpetual basis. The present value on a ten year basis is:

$$89{,}000/(F_{10.8\%}) = 89{,}000/1.863 = \$47{,}770$$

An alternative evaluation of the last step follows. The advantage of \$89,000 as a capitalized cost is equivalent to an end-of-year yearly savings of (0.08)(89,000) = \$7,120, the present value of which is:

$$\begin{aligned} 7{,}120[1/(1 + r) + 1/(1 + r)^2 + \cdots + 1/(1 + r)^{10}] \\ &= 7{,}120(G_{1.8\%})/(F_{10.8\%}) \\ &= 7{,}120(12.50/1.863) \\ &= \$47{,}770 \end{aligned}$$

Find Your End-of-Year Expenses

Some analysts consider yearly expenses to occur at the end of the year while we use the beginning of the year. In Eq. (8), the uniform yearly expense M refers to the beginning of the year. The corresponding equation for M' where M' refers to end of the year:

$$K_t = M'(G_{1,r})(1 - t) \tag{15}$$

For Eqs. (8) and (15) to be equal:

$$M' = M(1 + i) = M[1 + r/(1 - t)]$$

Similarly in Eq. (10) B_x refers to the beginning of the year. The corresponding equation for B'_x where B'_x refers to the end of the year is:

$$K_t = F_{m,r}(1 - t) \sum_{x=1}^{x=m} B'_x/I_{x,r} \tag{16}$$

For Eqs. (10) and (16) to be equal:

$$B'_x = B_x(1 + i) = B_x[1 + r/(1 - t)]$$

Other Depreciation Methods

For figuring depreciation, the sum-of-the-digits is one of the more advantageous and simpler methods to use. If another method is used the only term that changes is the ψ factor.

The ψ factor is calculated by finding the present worth of the depreciation, expressed as a fraction, for all the years over which the depreciation will occur. For example, in the case of straight-line depreciation, the depreciation is constant from year to year and expressed as a fraction is $(1/m)$.

The present value of this taken for m years is:

$$\psi_{m,r}^{SL} = \sum_{x=1}^{x=m} (1/m) \times 1/(1 + r)^x$$

$$\psi_{m,r}^{SL} = (1/m)(G_{1,r}/F_{m,r})$$

where the superscript SL denotes straight-line depreciation. Whatever the method used for depreciation:

$$\psi_{1,r} = 1/(1 + r)$$
$$\psi_{\infty,r} = 0$$

To Apply to an Entire Venture

Capitalized cost can be applied to an entire venture by combining suitable equations. Thus we have Eq. (17) shown above where C_d is the depreciable initial cost of the facility lasting m years and written off in m' years for tax purposes. B_x is the net yearly expense, before taxes and depreciation, referred to the beginning of the x-th year. For most years, B_x must be negative; a net income if the project is to pay off. The working capital is C_w and L is the salvage value.

If K_t is negative then the project pays off at a rate better than r. If K_t is positive then the project will not pay off at the rate r, but it is not necessarily a loser as it might pay off at some return less than r.

If B'_x which refers to the end of the year, is used, Eq. (17) becomes Eq. (18) as also shown above.

Happel[1] gives a relationship similar to Eq. (18) but divided by $F_{m,r}$. He also considers income positive while we consider an expenditure positive.

REFERENCES

1. Happel, J., *Chem. Eng. Prog.*, 51, p. 533 (1955).
2. Jelen, F. C., *Chem. Eng.*, Feb. 1954, pp. 199-203.
3. Chartener, W. H. and E. T. Thompson, *Chem. Eng.*, Dec. 1954, pp. 171-174.

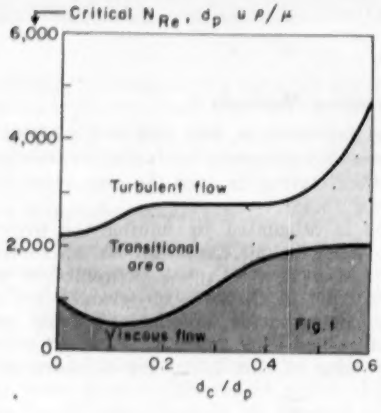
Methods for Gas or Liquid Flow

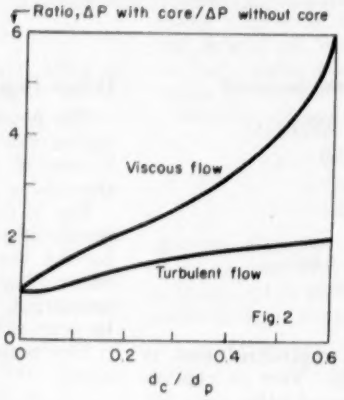
Maxey Brooke, Chemical Engineer, Old Ocean, Tex.
(For author biography see *Chem. Eng.*, July 1957, p. 318.)

29. Fluid Flow Through Annular Space

PROCEDURE

Determine pressure drop of the fluid through a length of straight pipe without the core.
Calculate Reynolds number and d_c/d_p to determine nature of fluid flow from Fig. 1.
From the appropriate curve of Fig. 2 and the ratio of d_c/d_p, find the factor for the pressure drop ratio.
Multiply the factor for the pressure drop ratio by the value computed for the straight pipe without the core.





NOMENCLATURE*

N_{Re}	Reynolds number
d_c	Core diameter
d_p	Pipe diameter
u	Fluid velocity
ΔP	Pressure drop
μ	Fluid viscosity
ρ	Fluid density

*Consistent units

REFERENCE

Piercy, *Phil. Mag.*, **15**, p. 647, (1933)

30. Fluid Flow Through Annular Space

APPLICATION

Pressure drop for fluids flowing through annular spaces with an eccentric solid core.

FORMULA

$$P = \frac{0.355\,(1-0.164e^{2.25})\,w\,L\,U^2}{(1-E)^{1.85}\,(N_{Re})^{0.25}\,2gD_1}$$

LIMITATION

For Reynolds numbers between 12,000 and 190,000.

REFERENCE

Uematu, *Trans. So. Mech. Engr.*, Japan, **2**, 56 (1936)

NOMENCLATURE

D_1	Diameter of pipe, ft.
D_2	Diameter of core, ft.
E	Ratio D_2/D_1
L	Length of pipe, ft.
N_{Re}	Reynolds number
P	Pressure drop, lb./sq. ft.
U	Velocity, fps.
e	Eccentricity ratio $2r/(D_1-D_2)$
g	Conversion constant, 32.2 ft./sec.^{2}
r	Eccentricity or distance between center lines of core and pipe, ft.
w	Specific gravity, lb./cu. ft.

31. Fluid Flow Through Pipe Bends

PROCEDURE

Determine equivalent length of straight pipe from the data given in the table. Use appropriate formula to calculate friction loss.

NOTE

For square elbows, 45° bend is equivalent to 47.8 pipe diameters; 90° bend is equivalent to 74.6 pipe diameters; 180° bend is equivalent to 100 pipe diameters.

REFERENCE

F. L. Snyder, *Heating, Piping and Air Conditioning*, Jan. 1935.

Equivalent Length of Straight Pipe in Pipe Diameters

R/D*	45° Bend	90° Bend	180° Bend	R/D*	45° Bend	90° Bend	180° Bend
0.1	42.0	65.5	87.7	2.2	6.1	9.6	12.9
0.2	37.3	58.3	78.1	2.4	5.9	9.3	12.4
0.3	33.2	52.0	69.6	2.6	5.8	9.1	12.2
0.4	29.4	46.0	61.6	2.8	5.8	9.0	12.0
0.5	25.6	40.0	53.6	3.0	5.7	8.9	11.9
0.6	21.8	34.0	45.5	3.2	5.8	9.0	12.0
0.7	18.2	28.5	38.2	3.4	5.8	9.1	12.2
0.8	15.4	24.0	32.2	3.6	5.9	9.3	12.4
0.9	13.1	20.5	27.5	3.8	6.1	9.6	12.9
1.0	11.5	18.0	24.1	4.0	6.4	10.0	13.4
1.2	9.5	14.8	19.8	4.2	6.7	10.4	13.9
1.4	8.3	13.0	17.4	4.4	6.9	10.8	14.5
1.6	7.4	11.6	15.5	4.6	7.2	11.3	15.1
1.8	6.8	10.7	14.3	4.8	7.5	11.8	15.8
2.0	6.4	10.0	13.4	5.0	7.9	12.3	16.5

* Radius of bend/Nominal pipe diameter

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Use this list of critical references on heat transfer, heat exchangers, chemical engineering and kinetics as a practical aid in solving your design problems.

RALPH CUSHING, Senior Process Engineer, Monsanto Chemical Co., St. Louis, Mo.*

Heat Transfer

General

"Heat Technology," Chilton, C. H. and T. R. Olive, *Chem. Eng.*, June 1953, pp. 175-185.
Thermal spectrum of heat technology; methods of production of heat and cold; melting points metals and oxides; heat containment; heat transport; temperature levels of typical processes; chart form with explanatory text.

"Advances in Heat Transfer," Bonilla, C. F., *Chem. Eng.*, June 1953, pp. 228-232.
Recent developments in theoretical knowledge; analogy with fluid flow; unsteady state transfer; transfer at high velocity; heat transfer in boiling; use of electrical analogues. Curves given for Von Karnian and Deissler isothermal velocity distribution, and Nusselt number vs. Peelet number for heating of liquid metals in turbulent flow.

Direct Fired Processes

"Tubular Process Furnaces," Bliss, C., *Chem. Eng.*, June 1953, pp. 208-212.
Uses of tubular furnaces; thermal efficiency; natural and forced circulation; designing for uniformity of heat transfer rate; effect of tube length and location; economic consideration.

"Fuels—Choice and Handling," McCabe, J. C., *Chem. Eng.*, June 1953, pp. 186-189.
Price and availability; comparative properties of major fuels in chart form; combustion characteristics; storage and handling; new fuels; process wastes as heat sources.

"Combustion Theory & Practice," Jensen, W. P., *Chem. Eng.*, June 1953, pp. 190-195, 221.
Reaction mechanisms; fundamentals of combustion; ignition and flame propogation; graphical & textural; combustion of unmixed jet fuels; discussion of the function of combustion equipment, illustrated; pulverized coal, gas, oil burners and jet burners discussed.

"Metals for Extreme Temperatures," Hoover, M. M., *Chem. Eng.*, June 1953, pp. 212-215.
Selection of metals for high and low temperatures; effects of creep and embrittlement; graphical illustration of creep and yield strength, and rupture strength vs. temperature; thermal expansion; high temperatures, effect on metallurgical properties and structure; low temperature effects on design.

* Meet your author on page 341.

"Refractories for Every Use," Norton, C. L., Jr., *Chem. Eng.*, June 1953, pp. 216-220.
Description, classification, uses and properties of refractory materials, (chart); silica, magnesite, chrome, forsterite, silicon carbide, fused alumina, zircon, zirconia, carbon, insulating firebrick, castable refractories, refractory mortars, plastic and ramming and compared; cost data comparison.

Indirect Heating

"Electric Heating Methods," Chilton, C. H., *Chem. Eng.*, June 1953, pp. 195-199.
Introductory classification of methods; energy relationships; resistance heating, arc heating, infrared heating, induction heating, dielectric heating are discussed.

"Media for Heat Transport," Carberry, J. J., *Chem. Eng.*, June 1953, pp. 225-228.
Evaluation of transport media on the basis of correlations of heat transfer coefficients vs. pumping energy. Graphical presentation, film coefficients vs. horsepower for low, medium and high temperature ranges. Low and high temperature media discussed. Graphical presentation of heat carrying capacity at given velocities for high temperature media.

Calculation Methods and Data in Heat Transfer

"An Easy Way to Determine Heat Transfer Coefficients," Winston, R. E., and L. Clark, *Pet. Refiner*, May 1956, pp. 227-229.
A method for estimating film coefficients of heat transfer to liquid hydrocarbons flowing through tubes. The method is designed for use when thermal conductivities and specific heat data are lacking.

"New Data Fill Vacuum," Miller, Byrne and Benforado, *Chem. Eng.*, March 1956, pp. 116, 118.
Experimental data for the case of heat transfer to a fluid in turbulent flow parallel to bundles of tubes or rods; of considerable value in heat transfer calculations for reactor cooling.

"Shortcuts For Transient Heat Flow," Granet, I. and R. M. Gould, *Chem. Eng.*, Feb. 1956, pp. 183-186.
Review of available methods; analytical; graphical; approximations; Schmidt's rule; Fowler's rule.

"Quick Answer to Heat Transfer Equation," Flynn, T., *Chem. Eng.*, Jan. 1956, p. 220.
Nomograph for solution of the heat transfer equation $Q = UA\Delta t$.

"Condensation Film Coefficients Plotted," Venkateswarlun, D., *Chem. Eng.*, Sept. 1955, pp. 210-211.
Curves given for coefficients on vertical tubes, experimental results for methyl, propyl, butyl, and amyl alcohols; methyl, ethyl, propyl, and butyl acetates; acetone, benzene, chlorobenzene, steam.

"Chart For Fin Efficiency Calculation," Tang, Y. S., *Pet. Refiner*, Aug. 1955, pp. 108-109.
Derivation; explanation and application of the fin efficiency relation to heat transfer in finned tubes; nomographic determination of fin efficiencies.

"Chart Finds Air-Film Coefficients," Osburn, J. O., *Chem. Eng.*, Aug. 1955, pp. 204, 206.
Heat flow by natural convection from horizontal cylinders to still air; nomograph reduces the work in trial and error calculations of surface temperature for pipes that are poor conductors e.g. glass, plastic, etc. or for insulated pipes. Nomographic determination of air-film coefficient.

"Time Saving Heat Transfer Performance Curves," Granet, I., *Chem. Eng.*, March 1955, pp. 187-190.
Graphical method which can be used in predicting the effect of fouling of convection surfaces; changes in thermal conductivity can be used to determine the amount of fouling that has taken place; no trial and error calculations required; may be used where heat transfer includes radiation of nonluminous type.

"Quick Estimation Method for Tube Wall Temperature," Tang, Y. S., *Chem. Eng.*, Dec. 1954, pp. 216-218.
Simplified method for graphical determination of tube wall temperatures in the convection section of furnace or pipe still; reduces tedious trial and error calculations in determining heat transferred by radiation and convection.

"New Charts Help Obtain Convection Heat Transfer Coefficients," Bates, H. T., *Chem. Eng.*, Nov. 1954, pp. 252, 254.
Liquid metal coefficients based on modified Sieder and Tate procedure; new graph plots f vs Prandlt number at various Reynolds numbers.

"Nomograph Gives Film Coefficient for Exterior Tubular Coolers," Davis, D. S., *Chem. Eng.*, Nov. 1954, p. 250.
Nomograph for calculation of coefficients for water flowing by gravity over the outside of long tubes.

"Cooling Liquids with Finned Coils," Katz, Young, Williams, and Balekjian, *Pet. Refiner*, Sept. 1954, pp. 303, 306.
Correlation of heat transfer and pressure drop data for finned tubes, based on tube diameter, transverse and longitudinal spacing, fin height, fin spacing, ratio of fin diameter to root diameter.

"Finned Tubes in Heat Exchangers," Williams, R. B. and D. L. Katz, *Pet. Refiner*, March 1954, pp. 145-149.
Results of test comparing plain and finned tubes in shell and tube exchangers; application of data to design; chart to determine whether finned tube will be economical, given viscosity and fouling factors; pressure drop; friction factors; baffle spacing; some cost data.

"Heat Transfer Coefficients for Heating or Cooling in Tubes," Tang Y. S., *Chem. Eng.*, Dec. 1953, pp. 174-176.
Nomograph presenting the Seider and Tate relationships with several variables transformed into dimensionless groups permitting easy comparison of the effect of changing individual variables on the heat transfer coefficients.

"Nomograph for Easy Batch Cooling Calculations," Seco, M. F., *Chem. Eng.*, Dec. 1953, pp. 172-173.
Nomographic calculation of the Troupe method below; arranged so as to permit comparison of different sets of conditions; allows selection of optimum conditions, determination of transfer areas, or batch temperature at time θ: curve based on water coolant; can be corrected for other coolants.

"L and K Factors for Heat Transfer Calculations," *Chem. Processing*, Jan. 1953, p. 166.
Tabular listing of tube-wall thicknesses vs. Birmingham wire gage; values of thermal conductivity for a variety of materials of construction.

"How To Tailor Exchanger Area To Fit Batch Cooling Time," Troupe, R. A., *Chem. Eng.*, Sept. 1952, pp. 128-131.
A method for the calculation of area required to cool a liquid batch in a given time interval; applicable to external exchanger or to jacketed tank; comparison of the design advantages of these two alternates.

"Short Cuts to Heat Transfer Coefficients," Davies, G. F., *Chem. Eng.*, Aug. 1951, pp. 122-124.
Procedures for simplified estimation of coefficients; double pipe exchangers, shell and tube, cascade coolers, coils and jacketed vessels, boiling films, condensers and gas heaters dealt with.

"Heat Transfer Calculations For Extended Surfaces," Schmidt, T. E., *Refrigerating Eng.*, April 1949, pp. 351-357.
Rather complete discussion of theory and practical data: fin efficiency; coefficients; distribution of tem-

perature within the fin; economic considerations as affecting design.

"Nomographs For Heat Transmission By Conduction in the Unsteady State," Davis, D. S., *Chem. Ind.*, March 1947, pp. 466, 468, 470.
Nomographic form of Gurney and Lurie charts for unsteady state conduction for cylinders, spheres and slabs.

Heat Exchangers

Selection

"Heat Exchangers and Condensers," *Manual No. 837*, Pfaudler Co.
Applications; mechanical design features; materials of construction; installation; operation; maintenance; thermal design data; log mean temp. difference nomograph; LMTD temp. correction curves; film coefficients in tabular and graphical forms; pressure loss curves; velocity limitations; overall *U*'s; tube constants; fouling factors; physical properties of organic liquids and gases.

"Heat Exchangers," Skrotzki, B. and S. Waldron, *Power*, June 1954, pp. 75-106.
Simplified approach; selection; factors affecting design; evaporators; surface condensers; auxiliaries; materials of construction; maintenance and cleaning; barometric condensers; deaerating heaters; extensively illustrated.

"Trends in Heat Exchangers," Smith, J., *Chem. Eng.*, June 1953, pp. 232-238.
Improvements in shell and tube designs; design features to facilitate cleaning and maintenance; special tubular exchangers; extended surface exchangers; plate exchangers, spiral exchangers; materials of construction for better corrosion resistance; list of manufacturers for various types of exchangers described; illustrated.

Design

"How to Design Cooler-Condensers," Bras, G. H. P., *Pet. Refiner*, June 1956, pp. 177-185.
Simplified approach to the usual complex and tedious calculations in the design of tubular cooler condensers; review of Colburn and Hougen method, Cairn's method and others; development of equations and procedure for simplified yet accurate method; example worked out in detail; a numerical and graphical system.

"How to Design the Optimum Heat Exchanger," Cichelli, M. T. and M. S. Brinn, *Chem. Eng.*, May 1956, pp. 196-200.
Simplified method for obtaining the economical optimum design for shell and tube heat exchangers; avoids trial and error solution; method allows solution with only one unknown in each of two separate equations; fifteen step procedure outlined.

"Design Heat Exchangers More Exactly," Fabregas, J., *Chem. Eng.*, April 1956, pp. 181-184.
A method to determine shell side leakage past baffles; charts for determination of *F*, tabulated correction factors for pressure drop, pitch and diameter; nomographs for determining heat transfer leakage correction factor.

"Make Your Heat Exchanger Design Estimates More Complete," Auro, M. and E. Andres, *Chem. Eng.*, March 1956, pp. 208, 210.
Nomographic presentation of heat exchanger calculations for quick evaluations; solves for surface, number of tubes and shell diameter.

"Heat Exchangers," Donohue, D. A., *Pet. Processing*, March 1956, pp. 101-132.
Simplified approach; well illustrated; selection; mechanical construction details; process design, graphical solutions of LMTD, MTD correction factors; cases handled, fluid inside tubes, segment baffled shell, condensation, condensate film on vertical tube, condensation of vapor in presence of non-condensable gas, evaporation, extended surfaces; mechanical design considerations; specification sheets; materials of construction; operation data on duties for coolers, heaters, exchangers, vaporizers, condensers, several types in each category discussed; installation and maintenance; cost data.

"How to Design Barometric Condensers," How, H., *Chem. Eng.*, Feb. 1956, pp. 174-182.
Types; applications; tabulation of vapor pipe sizes at various steam flow rates; cooling water inlet sizes at various flow rates; basic design; variations; hot well design; installation and operation.

"Heat Exchanger Design—Mechanical Design," Donohue, D. A., *Pet. Refiner*, Jan. 1956, pp. 155-160.
Design considerations; tubes and tube sheets; baffles; heads; shell, channels, flange design, bolt loads; basis of design API-ASME code; very detailed.

"How to Specify Heat Exchangers," Glanaser, W. and J. Cortright, *Chem. Eng.*, Dec. 1955, pp. 203-206.
Specifications to be supplied the manufacturer given in tabular form. Problems arising in standardization; requesting bids; process design problems.

"Heat Exchanger Design—Fluid Flow and Thermal Design," Donohue, D. A., *Pet. Refiner*, Nov. 1955, pp. 175-184.
Pressure drop nomographs; viscosity gradients; pressure drop through baffle openings; friction factor curves for flow across tube banks; pressure drop nomographs for flow across tube banks; overall coefficients of heat transfer.

"Heat Exchanger Design—Heat Transfer," Donohue, D. A., *Pet. Refiner*, Oct. 1955, pp. 129-138.
Basic equations; graphical LMTD; MTD correction factors; graphical solution of coefficients; Reynolds number nomograph; tube wall resistances; flow in tubes; flow outside of tubes; fouling factors; shell side coefficients in exchangers having segmental baffles; shell side coefficients for petroleum oils.

"Heat Exchanger Design; Types and Arrangements," Donohue, D. A., *Pet. Refiner*, Aug. 1955, pp. 94-100.
Shell construction; tube layout; flow areas and flow paths; evaluation of shell-side flow areas and number of constrictions without a tube layout. Maintenance and cleaning.

"Heat Exchanger Expansion Calculations," Granet, I., *Pet. Refiner*, Aug. 1955, pp. 101-104.
Relative expansion between tubes and shell of a fixed tube sheet exchanger; cases considered, boiling on shell side, counter flow and parallel flow operation.

"Reconsider The Numerical Solution," Gross, J. F., *Chem. Eng.*, June 1955, p. 245-246.
For the case of boiling or condensing fluid on the shell side.

"Aluminum Alloy Heat Exchangers in the Process Industries," Binger, W. W. and H. W. Fritts, *Corrosion*, Dec. 1954, pp. 425-431.
Experimental data showing resistance of aluminum to corrosion and erosion in heat exchanger applications; friction factor curve for aluminum tubes; mechanical specifications.

"How to Design Gas-Cooling Towers," Bras, G., *Chem. Eng.*, Dec. 1954, pp. 191-194.
Development of methods and equations; humidification, scrubber-cooler design; derivations of equations shown.

"How to Design for Low Temperatures," Sweeney, R. J., *Chem. Eng.*, July 1954, pp. 197-202.
General approach; graphical presentation of relative

heat transfer of dry low-pressure gas in tubes, relative flow capacity of low pressure gas in tubes; physical properties of paraffins; condensation with liquid flow, turbulent flow transition; Carpenter, Colburn condensation; condensing mixed with noncondensibles; evaluation of the Schmidt number; evaporation heat transfer; heat transfer properties of Freon-12 liquid.

"Nomograph Gives Water Rate of Heat Exchangers," Smith, B., *Chem. Eng.*, Feb. 1954, pp. 230, 232.
A nomograph to reduce the time in calculating water rates for given duties and at given temperature rise.

"Simplified Method for Sizing Gas Heat Exchangers," Devore, A., *Chem. Eng.*, July 1953, p. 187.
Heat transfer and pressure drop equations for gases in segmentally baffled flow.

"Design of Cooler Condensers for Vapor-Gas Mixtures," Bras, G. H., *Chem. Eng.*, April 1953, pp. 223-226.
Graphical method for design of cooler condensers for handling mixtures of noncondensible gases and saturated or non saturated vapors.

"Shortcut to Heat Exchanger Design Part I," Gilmour, C. H., *Chem. Eng.*, Oct. 1952, pp. 144-148.
Equations and nomographs for accurate design of heat exchangers for conditions of no phase change and cross-flow in shell; eliminates need for thermal conductivity and specific heat data; puts all calculations on single sheet; cuts designing time in half.

"Shortcut to Heat Exchanger Design Part II," Gilmour, C. H., *Chem. Eng.*, March 1953, pp. 226-229.
Equations and nomographs for conditions of no phase change and parallel flow in shell.

"Shortcut to Heat Exchanger Design Part III," Gilmour, C. H., *Chem. Eng.*, April 1953, pp. 214-218.
Equations and nomographs for design of heat exchangers for conditions of phase change as in heaters and condensers: horizontal, vapor in tube; horizontal, vapor in shell; vertical, vapor in tube; vertical, vapor in shell; thermal and mechanical design.

"Shortcut to Heat Exchanger Design Part IV," Gilmour, C. H., *Chem. Eng.*, Oct. 1953, pp. 203-207.
Equations and nomographs for design of heat exchangers for conditions of vapor deposition and condensate subcooling; condensates of miscible liquids, and cross-flow in shell; vertical vapor in tube condenser and subcooler.

"Shortcut to Heat Exchanger Design Part V," Gilmour, C. H., *Chem. Eng.*, Feb. 1954, pp. 190-194.
Equations and nomographs for design of heat exchangers for conditions of vapor deposition and condensate subcooling, condensates of immiscible liquids, and cross-flow in shell.

"Shortcut to Heat Exchanger Design Part VI," Gilmour, C. H., *Chem. Eng.*, March 1954, pp. 209-213.
Equations and nomographs for design of heat exchangers for conditions of vapor condensation from mixtures for vapor and non-condensable gases; development of equations given.

"Shortcut to Heat Exchanger Design Part VII," Gilmour, C. H., *Chem. Eng.*, Aug. 1954, pp. 199-206.
Equations and nomographs for design of heat exchangers for reboilers, horizontal, vertical or inclined tubes; calculation of liquid flux not required.

"Quick Estimation Method for Heat Exchanger Dimensions," Davis, G. F., *Chem. Eng.*, March 1952, pp. 170-171.
Graphical estimation methods for quickly determining basic overall dimensions of heat exchangers; particularly valuable in preliminary evaluations.

"Planning Refinery Heat Transfer Equipment Part I," Hicks, T., *Pet. Refiner*, Sept. 1950, pp. 97-101.
Basic relations; generalized equations; MTD correction factors; tabulation of generalized overall *U's*; film scale coefficients for petroleum.

"Planning Refinery Heat Transfer Equipment Part II," Hicks, T., *Pet. Refiner*, Oct. 1950, pp. 95-98.
Efficiency and operating relations; cost curves for optimum area; costs and optimum velocities; efficiency equations; example calculations; operating equations for counter and parallel flow.

"Planning Refinery Heat Transfer Equipment Part III," Hicks, T., *Pet. Refiner*, Nov. 1950, pp. 113-115.
Economical proportions; relation between relative costs and area, tube length, pressure, in graphical form; relation between costs and standardized exchanger dimensions; baffling arrangements; equations for pumping costs per BTU transferred for shell and tube side; fixed charges; total exchanger operation costs per BTU; optimum coolant flow and operation temperature.

"Nomograph For Determination of the Diameter of a Heat Exchanger Tube Sheet," Davis, D. S., *Chem. Ind.*, Feb. 1948, p. 294.

"Tube Sheet Layout Tables," *Downingtown Heat Exchanger Bulletin*, pp. 12-14.
Tabulations of mechanical arrangements for tubes in heat exchangers.

"Design Manual for Pyrex Brand Heat Exchangers," *Bulletin P.E. 33*, Corning Glass Works.
Mechanical and thermal considerations in design of glass exchangers; alignment charts for overall coefficients; surface areas; pressure drops; tabulation of heat capacities of liquids and gases at 50, 100, 150, 200, 300, 400 F.

Chemical Engineering

Basics

"How To Solve Engineering Problems," Warzecka, L. W., *Chem. Eng.*, Oct. 1954, pp. 230-234.
Method outlined for analyzing and solving engineering problems.

"Project Engineering," Gordon, D., *Chem. Eng.*, Mar. 1950, pp. 125-136.
Principles behind project engineering; preliminary study; preparation of the schedule; job specification; plans and flow sheets; design and drafting; installation and construction; startup. A detailed step by step procedure in managing a project.

Writing

"How Does Your Writing Measure Up . . . At These Nine Vital Points?," Gould, J. R. and N. G. Shidle, *Chem. Eng.*, July 1954, pp. 250-258.
A good article to use as a guide for written communications at every level of normal work.

Filing Articles

"What's The Best Way To File Technical Articles and Data?," Cushing, R., *Heating, Piping and Air Cond.*, July 1956, pp. 124-127.
A description of an engineering index that is simple and useful and allows you to find an article with the least amount of trouble and time.

"How To Find What You Need," Taube, M., *Eng. News-Record*, May 20, 1954, pp. 46-47.
A description of the basic method from which the above system was adapted; the "uniterm" system invented by Documentation Inc. of Washington, D. C.

Scaling Up

"How To Scale Up Pilot Plant Data," Jordan, D. G., *Pet. Refiner*, June 1956, pp. 129-135.

Sound principles of scale up; example given for mixing, distillation and reaction rates, showing varied techniques for each.

"What To Avoid In Scaleup," Thornton, D. P., Jr., *Pet. Refiner*, June 1956, pp. 136-139.
Problems involved in scale up and how to avoid some of them; heat effects; side reactions; metallurgical difficulties; entrainment.

The Use of Models

"Shortcut To Plant Startup," *Chem. Eng.*, April 1955, pp. 122-124.
Description of a new twist in the use of models for plant construction planning, where photographs of the model replace detailed piping plans.

Miscellaneous Calculations and Shortcuts

"Triangles Aid Replotting Of Curves," Ramsey, H. J., Jr., *Chem. Eng.*, Sept. 1955, p. 208.
A graphical method of replotting data to alter one coordinate scale.

"Simplify Refining Calculations," Murphy, L. J., *Pet. Refiner*, Feb. 1954, pp. 145-148.
Nomographs for solving for: (1) tank filling losses; (2) pipe coil length; (3) pipe schedule number; (4) electrical heating of pipe runs; (5) accident frequency and severity rates; (6) wrinkle bend length; (7) steam flow through orifices.

"Easy Sketching System," *Power*, Sept. 1953, p. 138.
A method of graphical presentation of volume or size comparison useful in presenting data in engineering reports.

"Easy Sketching System," *Power*, Aug. 1953, p. 140.
A method of graphical presentation of reducing quantities such as decreasing percentages to represent savings in engineering reports.

"Easy Sketching System," *Power*, July 1953, p. 142.
Dressing up uninteresting curves in statistical reports by representing figures in three dimensional sketches.

"Pressure Conversion," Blouch, C. H., *Chem. Processing*, Jan. 1953, p. 172.
Head in feet of fluid vs. psi. (nomograph).

"Nomograph For Calculating Volume Of Liquid In Tilted Tanks and Drums," Zenz, F. A., *Chem. Processing*, July 1952, pp. 156-158.
Nomographic form.

"Charts Presented To Aid Refinery Designers and Operators," Hicks, T. G., *Pet. Refiner*, Nov. 1951, pp. 134-156.
Rectangular alignment charts simplify routine calculations such as: (1) air receiver pump up time; (2) steam line warm-up condensate; (3) engine cooling water temperature rise; (4) steam for heating water; (5) operating cost of gas engines.

Heat and Material Balances

"Heat and Material Balance," Bottomley, H., *Pet. Refiner*, Jan. 1954, pp. 159-161.
A step by step procedure for tabulating heat and material balance data to produce a workable tool for design and operating calculations, or both.

Selection of Variables

"How Many Operating Variables Can You Control?," Lorian, M. G., *Pet. Refiner*, Sept. 1953, pp. 219-223.
Basic ideas; equilibrium stage in flow contactors; multi-stage contactor; examples; the problem of over control.

Thermodynamics

"A Thermodynamics Refresher, Part I-VII," Lee, J. F., *Ind. and Power*, May-Dec. 1955.
A series that reviews the basic concepts of thermodynamics.

"Work—A Discussion Of Its Engineering Significance," Hutchinson, F. W., *Heating and Ventilating*, Dec. 1954, pp. 75-86.
Fundamentals; shaft work; circumferential force; flow work; loss of energy; pressure; enthalpy; specific and latent heats; valuable pressure; isothermal; adiabatic and isentropic expansion; polytropic expansion.

"The ABC Of Superpressure, Parts I-V," Swain, P., *Power*, Oct.-Dec. 1953, Jan.-Feb. 1954.
Comparison of steam properties at 250 psi., 1500 psi. and 2500 psi., saturation temperature; specific volume; enthalpy; steam without boiling in laboratory apparatus; fuel in superpressure steam; effect of rising pressure on plant thermal efficiency; six steam cycles; advantages; disadvantages.

"Chemical Engineering Fundamentals—Thermodynamics Principles, Parts I-III," Corrigan, T. E., *Chem. Eng.*, Sept.-Nov. 1953.

Part I, Sept. 1953, pp. 237-242.
Introduction; definitions; first and second laws of thermodynamics; classification of energy; heat capacity; energy balance over a flow system; work and heat; reversible processes.

Part II, Oct. 1953, pp. 237-242.
Entropy and the Carnot cycle; available and unavailable energy; fundamental energy; relations; thermodynamic relationships; transformations; entropy changes.

Part III, Nov. 1953, pp. 203-207.
Handling non-ideal gases; equations of state; law of corresponding states; enthalpy; entropy and heat capacity correction charts for gases.

"Practical Thermodynamics," Brown, G. G. and C. Sliepcevich, *Chem. Eng., Progress*, Oct. 1952, pp. 493-496.
A simplified version of a complex study with some practical applications to chemical engineering problems. First and seond laws of thermodynamics.

"Applications of Thermodynamics To Hydrocarbon Processing-General Thermodynamic Properties," Edmister, W. C., *Pet. Refiner*, June 1948, pp. 104-11.
Generalized thermodynamic properties derived and presented in tabular and graphical forms.

"Applications Of Thermodynamics To Hydrocarbon Processing—Derivations For Graphical P-V-T Correlations," Edmister, W. C. *Pet. Refiner*, May 1948, pp. 93-100.
Equations derived for eight thermodynamic properties of fluids in term of the compressibility factor and the volume residual $a(RT/PV)$. The evaluation of the required derivatives and the integration of the functions are illustrated by equations and charts covering the mechanics of calculating the thermodynamic properties.

Dimensional Analysis

"Learning How To Use Dimensional Analysis, Parts I-IV," Silberberg, I. H., and J. J. McKetta Jr., *Pet. Refiner*, April-July 1953.

Part I, April 1953, pp. 179-183.
Dimensions and dimensional systems; Newton's law of motion; absolute system; gravitational system; the engineering systems; a synthetic dimensional system.

Part II, May 1953, pp. 147-150.
Homogeneity as the basis of dimensional analysis; the Bernoulli equations in three systems of dimensions; examples.

Part III, June 1953, pp. 101-103.
The Rayleigh method presented with examples; the pendulum; pressure drop in fluid flow.

Part IV, July 1953, pp. 129-133.
Examples illustrating the Buckingham Theorem; heat transfer film coefficient; power characteristics, engineering applications.

Nomograph Use and Construction

"Nomograms . . . Make Your Own, Part I-IV," Winn, F. W., *Pet. Refiner*, Oct. 1955, Nov. 1955, Feb. 1956, Mar. 1956.

Part I, Oct. 1955, pp. 143-147.
Classification of nomograms; fundamentals of nomography; nomographic scales; how to construct the scales.

Part II, Nov. 1955, pp. 205-207.
Relative direction of the scales; choice of form; location of the "Z" scale stem; graduation of the scale stem; significance of slope; significance of intercepts.

Part III, Feb. 1956, pp. 121-124.
Nomogram with center "Z" scale; rectilinear plot to nomogram; nomogram with a center x or y scale; examples.

Part IV, Mar. 1956, pp. 171-177.
Rectification of empirical data; rectification by use of an empirical family of lines; prevention of extrapolation; construction from limited experimental data.

"Rectangular Nomographs—Four Sides To An Equation," Powell, W. E., *Prod. Eng.*, Mar. 1956, pp. 192-195.
Use of rectangular nomographs to solve equations; procedure for nomograph construction; assigning scales; direction of scales; scale lengths; alignment.

"Simplifying Data Correlations By Nomographs," Mapstone, G. E., *Pet. Refiner*, Jan. 1953, pp. 119-123.
An approach to data obtained as a family of curves which enables one to determine if a relation exists between a set of empirical lines; application of method; construction of charts; examples; interpretation of relationship.

"Simple Way To Draw Nomographs," Rhoden, M., *Chem. Eng.*, Nov. 1952, pp. 146-147.
A method for construction of many nomographs that fit many engineering equations and can be used without delving into nomographic theory.

Kinetics

Chemical Equilibrium

"Chemical Engineering Fundamentals—Chemical Equilibrium—Parts I-IV," Corrigan, T. E., *Chem. Eng.*, Mar.-June, 1954.

Part I, Mar. 1954, pp. 222-232.
Chemical reactions; heat of reaction; effects of temperature and pressure; flame temperature problems; incomplete reactions; theoretical explosion pressures.

Part II, April 1954, pp. 212-220.
Free energy, equilibrium constant; equilibrium composition; fugacity.

Part III, May 1954, pp. 202-210.
Calculation of equilibrium conversion for various reactions; the effect of dissociation on the theoretical flame temperature and standard states, adiabetic reactions; simultaneous reactions; equilibrium concentration problems.

Part IV, June 1954, pp. 244-248.
Theoretical flame temperature; effect of dissociation; standard states.

Reaction Kinetics

"Chemical Engineering Fundamentals—Introduction and Kinetics of Homogenous Reactions, Parts I-III," Corrigan, T. E., *Chem Eng.*, July-Oct. 1954.

"Introduction to Reaction Kinetics," July 1954, pp. 230-238.
Background and introduction; scope of kinetics; classification of chemical reactions; application to reactor design.

Part I, Aug. 1954, pp. 208-216.
Types of homogenous reactions; law of mass action; reaction order; mechanism of reaction; equations developed for different orders of reaction.

Part II, Sept. 1954, pp. 210-216.
Illustrative problems involving reaction order and reactor size; complex reactions; reversible reactions; numerical analysis of a complex reaction.

Part III, Oct. 1954, pp. 210-216.
Reactor size; flow reactions; space velocity and volume/feed ratio; temperature effect on reaction rates; theories of homogenous reactions discussed.

"Introduction To Chemical Reaction Calculations, Parts I-III," Platt, A. M., and G. L. Farrar, *Pet. Refiner*, Aug. 1951, Oct. 1951, Dec. 1951.

Part I, Aug. 1951, pp. 83-89.
Introduction; definition and examples of equilibrium; a brief treatment of chemical equilibrium from the stand point of chemical engineering thermodynamics.

Part II, Oct. 1951, pp. 147-152.
Chemical kinetics; law of mass action; reaction order; residence time; reactor sizing; derivations of equations given.

Part III, Dec. 1951, pp. 137-142.
Example calculations; equations for complex reactions; catalytic reactions; mass transfer and diffusion.

Catalytic Reactions

"Chemical Engineering Fundamentals—Catalysis and Adsorption, Parts I-II," Corrigan, T. E., *Chem. Eng.*, Nov.-Dec. 1954.

Part I, Nov. 1954, pp. 236-244.
Function of a catalyst discussed; rate-equilibrium balance in reactions pseudo-equilibrium; selectivity of catalysts; gas film diffusion; theories of adsorption; derivation of Langmuir's isotherm.

Part II, Dec. 1954, pp. 198-208.
Adsorption reactions; equations involving two or more gases; application of adsorption equations; determining adsorption constants; equilibrium equations.

"Chemical Engineering Fundamentals, Catalytic Vapor Phase Reactions, I-III," Corrigan, T. E, *Chem. Eng.*, Jan.-Mar. 1955.

Part I, Jan. 1955, pp. 199-202.
Adsorption and catalysis; catalytic rate equations; surface reaction controlling; desorption controlling.

Part II, Feb. 1955, pp. 195-200.
Rate equations; effect of inert gases; chain reactions vs. catalytic mechanisms.

Part III, Mar. 1955, pp. 197-200.
Empirical equations in catalysis; dirt factor; catalyst poisoning; integral reactor data; flow reactors best for kinetic data; integral and differential reactors .

Interpretation of Kinetic Data

"Chemical Engineering Fundamentals—Interpretation Of Kinetic Data, Parts I-IV," Corrigan, T. E., *Chem. Eng.*, April-July 1955.

Part I, April 1955, pp. 199-204.
Film diffusion; analysis of kinetic data and integral reactor data; initial rates.

Part II, May 1955, pp. 203-206.
Rate data at finite conversions; rate methods; interpreting differential-reactor data; mechanism for simultaneous reactions.

Part III, June 1955, pp. 253-256.
Fluidized beds; rate equations for fluidized beds; effect of diffusion; example problems.

Part IV, July, 1955, pp. 227-230.
Probable mechanism; calculated vs. experimental.

Order of Reaction

"Nomographs For Chemical Kinetics," Nord, M., *Chem. Ind.*, Oct. 1948, pp. 664-668.
Nomographs to allow solution for reaction order.

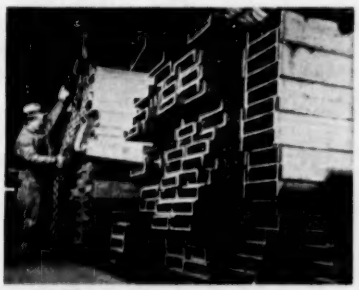
"Determination Of Reaction Order," Noddings, C. R., *Chem. Processing*, Nov. 1953, p. 63.
A graphical method of determining reaction order for simple reactions.

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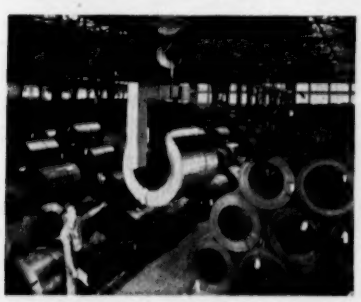
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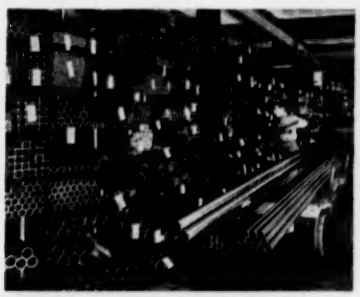
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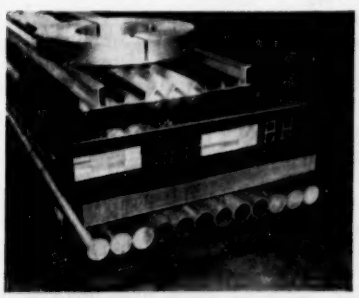
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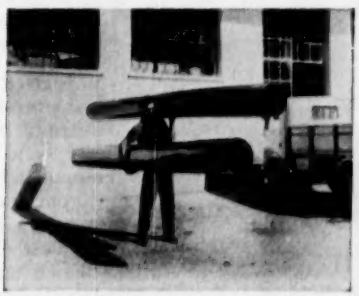
TUBING—Seamless and welded steel tubing—mechanical tubing, fluid line, pump cylinder and structural tubing.



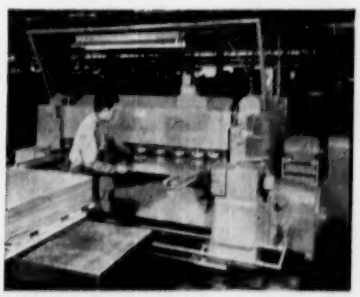
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Input rate − Output rate = Accumulation rate

$$\frac{dI}{d\theta} - \frac{dO}{d\theta} = \frac{dA}{d\theta}$$

FOR MATERIAL BALANCES AND HEAT TRANSFER . . .

How to Set Up the Necessary Mathematics

Develop your skills in handling mathematical terms for better understanding of the newer techniques in chemical processing.

WILLIAM E. BALL and R. CURTIS JOHNSON, Washington University, St. Louis, Mo.*

BEGINNING this month, your CE Refresher starts a new series on fundamental mathematics. In many cases we're confronted with mathematical terminology which though vaguely familiar has long since been forgotten. We'll try to recall the necessary mathematics that are needed to help you keep abreast of today's developments.

Our authors, William E. Ball and R. Curtis Johnson will present in the next several articles certain mathematical tools that every chemical engineer wants as background material in his work.

The authors will show how to express ideas and statements in mathematical shorthand. In so doing, they will show how to interpret correctly and apply the necessary mathematics. Next, they'll show how to introduce the correct physical and chemical properties into the mathematical forms. Finally, they will describe the various methods of solving the mathematical equations.

Importance of this refresher may be gaged by the increasing use of automatic computers and control systems in the chemical process industries. As a result, these new contributions to chemical processes have brought the chemical engineer into closer contact with electrical and electronic engineers.

Your ability to follow these newer techniques depends more and more on your understanding of the basic mathematics involved. In forthcoming installments, Ball and Johnson will discuss how some of the mathematical concepts in these related fields depend on similar mathematical relationships.

Our endeavor is to assist the chemical engineer in reacquainting himself with the mathematics of these fields. No pretense is made of giving an extensive survey of all mathematics. But we do hope that this mathematics refresher will help the chemical engineer develop a better understanding of the mathematics in the several related fields of engineering and its impact on his work.—EDITOR

We recognize that the work of most engineers, on the average involves problem solution. Most problems, in turn, require the use of at least some mathematics. Problem and solution statements, however, do not usually include any mathematics.

Thus a typical statement might be:

> Specify the most economical reactor setup to convert 5,000 lb./hr. of A to B with a minimum purity of 99%.

The answer, as summarized in a report, might be:

> The most economical setup consists of a shell and tube reactor. The tubes are to be ... ft. long, packed to a depth of ... ft. with catalyst X. A total of ... tubes in parallel is needed.
>
> The reactor is to be cooled with fluid Y, circulated at a rate of ... lb./hr., entering at ... deg. F. Auxiliary equipment will consist of a preheater (specifications), a distillation column (specifications), etc.
>
> The total cost will be $..., and the return on investment, calculated according to established company procedure, is ...%. Complete details are given in the attached report.

These oversimplified statements illustrate only the nature of initial information transmitted to the engineer; and the final information transmitted to the management. In between there may be anything from one hour's work for one man to more than a year's work for a team.

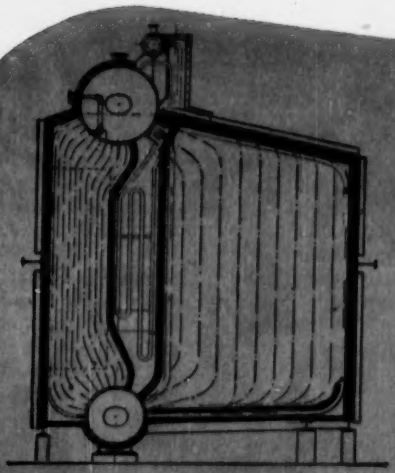
Regardless of the actual mathematical manipulations which may frequently be made by a professional mathematician, someone must first analyze the situation. The word statement of the problem must be properly interpreted.

The proper physical and chemical relationships must be found and interpreted in terms of the problem. A useable representation of physical and chemical properties must be derived. Such tasks must be performed by the engineer, whether he carries through the solution of the problem or not.

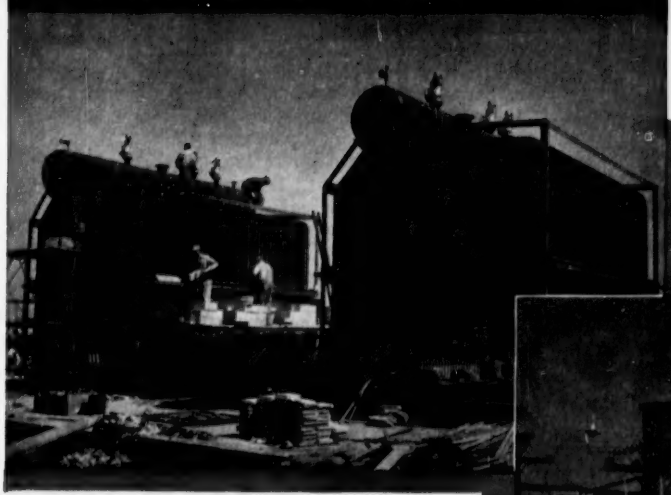
* Meet your authors on page 343 and 344.

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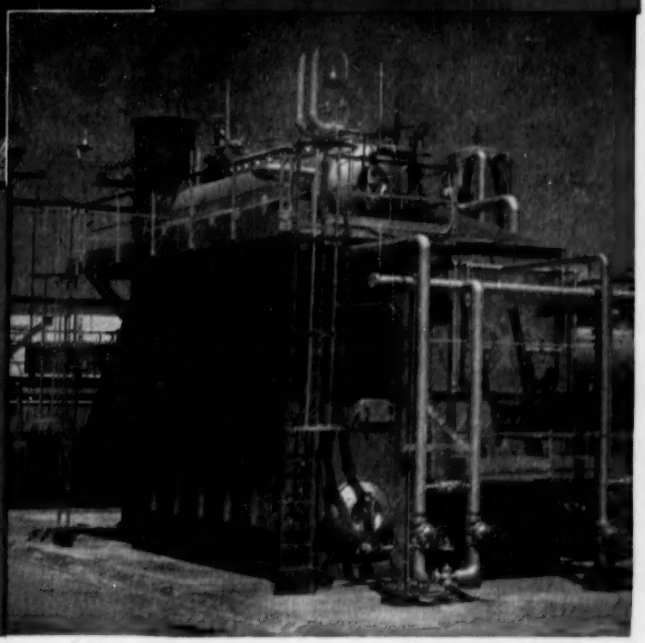


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Check for Dimensional Consistency

The engineering field involves the application of basic principles to problems of design, construction, manufacturing and the like. As such, we draw heavily on the results of investigations by mathematicians, chemists, physicists and engineers. As a result the engineering literature is cluttered with a baffling array of units and their combinations. It is of the utmost importance that every basic equation we write be dimensionally consistent. We will continually emphasize this point as we develop our equations and set up problems.

However, it is not our purpose here to discuss dimensional analysis and similitude. These topics have been the subject of an article in *Chem. Eng.*, Apr. 1954, pp. 185-190. They are covered in texts devoted to the subject[1, 2] and also in certain standard chemical engineering texts.[3, 4]

Basic Equations Involve Rates

In most of our engineering situations, we are confronted with some relationships which involve the rate at which something will take place. As soon as we detect this situation, we know that differential equations may be involved.

Of course, if we design a heat exchanger assuming counterflow and constant U, we use a standard equation involving the log mean temperature driving force. Hence we never see a derivative. But someone has integrated the equation for us.

Each physical and chemical phenomenon can be described by an appropriate equation or set of equations. The average engineering problem will make use of at least one equation for each phenomenon in the mathematical model of the problem. The number of phenomena to be described is limited. However, the combinations are infinite.

Therefore, it is to our advantage to look first at the relatively few equations of importance to us before the issue becomes clouded by all the details we could encounter. Note how many of these equations are based on rates, and contain derivatives.

Nomenclature (Consistent Units)

A_a	Accumulation
A	Area
c	Concentration
c_p	Heat capacity at constant pressure
c_v	Heat capacity at constant volume
D	Diameter
E	Internal energy
E_t	Total internal energy
F	Factor
h	Film heat transfer coefficient
H	Enthalpy
H_t	Total enthalpy
I	Input
k	Thermal conductivity
L	Length
M	Mass
O	Output
P	Perimeter
q	Rate of heat transfer
Q	Total heat transferred
R	Rate
S	Weight of salt
T	Temperature
t	Temperature
U	Over-all heat transfer coefficient
V	Volume
W	Weight of solution
W	Rate of feed
x	Distance
a	Factor $= 0.8U/c_p$
θ	Time
λ	$\lambda^2 = hP/kA$
ρ	Density
σ	Stefan-Boltzmann constant

Use Basic Equations for Material Balances

We are accustomed to making a material balance early in the solution of most chemical engineering problems. Therefore, it is logical to consider it first in our presentation here. The whole field of stoichiometry is often wrapped up in the single statement input minus output equals accumulation, or

$$I - O = A_a \qquad (1)$$

This equation can be applied to total mass of material, moles of elements and in the absence of chemical reactions, moles of compounds.

While most chemical equipment is designed on the basis of steady state operation, much is still done with batch equipment. Here rates of input, output and accumulation vary with time. Also, there are fluctuations in plant equipment which is nominally steady-state.

Furthermore, present methods of testing equipment (frequency response, etc.) may cause deviations from steady-state conditions. Thus it is necessary to consider differential material balances. Instead of Eq. (1), we write

$$dI - dO = dA_a \qquad (2)$$

Since we will most be concerned with time variation, we can divide Eq. (2) by $d\theta$. This converts our fundamental equation to a rate equation expressed as: rate of input minus rate of output equals rate of accumulation, or

$$dI/d\theta - dO/d\theta = dA_a/d\theta \qquad (3)$$

Since Eq. (3) possesses considerable generality, we might explore some of the possibilities.

True Steady State Operation

In true steady state operation, accumulation is zero. Here $dA_a/d\theta = 0$; then $dI/d\theta = dO/d\theta$ or,

$$dI/d\theta = dO/d\theta = R = \text{constant} \qquad (4)$$

If the rate does not change with time

$$d^2I/d\theta^2 = d^2O/d\theta^2 = 0 \qquad (5)$$

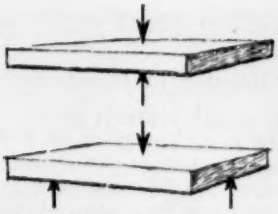
False Steady State Operation

We might observe a piece of equipment and note that the level remains constant. Therefore, we interpret this phenomenon as steady state. However, it is possible that $dA_a/d = 0$, while

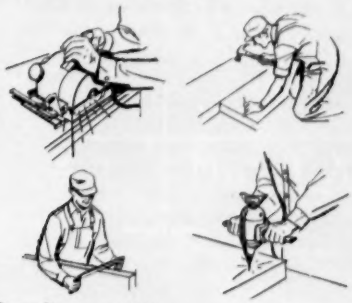
$$dI/d\theta = dO/d\theta = R \neq \text{constant} \qquad (6)$$

and

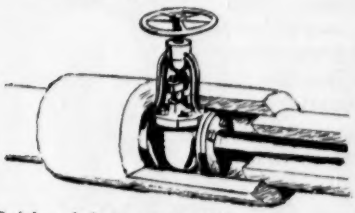
$$d^2I/d\theta^2 = d^2O/d\theta^2 \neq 0 \qquad (7)$$



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The Basic Material Balance

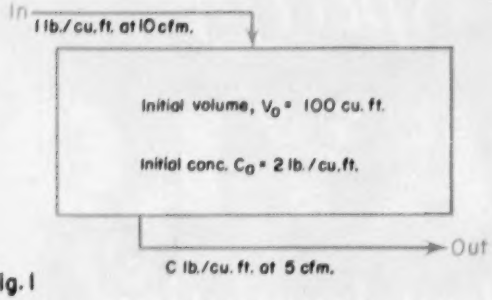


Fig. 1

As an example consider a constant-head tank which is filled to the overflow point. It is quite possible to consider the tank itself as steady, in that its contents do not change. But the rate of inflow and equal rate of outflow can change in response to system demands.

The definition of steady state requires that not only temperature, pressure, mass and flow rates, but also compositions at any point be constant. For this reason, Eq. (4) and (5) defining true steady state must be true for each chemical element as well as for total mass. In physical processes, where no chemical reaction occurs, the equations may be written for compounds as well as elements.

Batch Operations

In batch operation one or more of the terms in the basic equation (3) is missing. For example:

• In mixing and blending, there is no outflow. Then

$$dI/d\theta = dA_e/d\theta \qquad (8)$$

• In batch separation such as distillation, there is no inflow, and

$$-dO/d\theta = dA_e/d\theta \qquad (9)$$

• In a batch reaction such as heating a reaction mixture in an autoclave without addition or removal of material

$$dA_e/d\theta = 0 \qquad (10)$$

for the total mass of material and for the individual elements in the reaction mass. However, if a chemical reaction is occurring Eq. (10) does not hold for the reacting chemical compounds. Their rates of accumulation or depletion must be obtained from equations expressing the kinetics of the chemical reaction.

Some operations are called batch by some writers and semi-continuous by others. These might be characterized physically by the fact that their operation is intermittent; and mathematically by Eq. (3) where there is input, output and accumulation. A plate and frame filter press would fit this category. A rotary filter would be true steady state when viewed as a whole, although an inch-by-inch analysis of its operation would place it in the semi-continuous class.

Problems Illustrate Meaning of Equations

Problem 1—Initially a tank contains 100 cu. ft. of a salt solution with a concentration of 2 lb./cu. ft. At a given time a solution with a concentration of 1 lb./cu. ft. is fed into the tank at a rate of 10 cfm. At the same time solution from the tank is removed at a rate of 5 cfm. Derive equations representing the change in total material and concentration in the tank as functions of time.

Solution—It is usually helpful in visualizing the problem to make a simple carefully-labelled diagram of the process such as in Fig. 1. Then it is necessary to state any assumptions used in setting up the equations.

Having no information about any temperature changes due to mixing or about the effect of concentration on density, we must neglect these factors. We thus assume volumes are additive. We further assume that complete and immediate mixing occurs in the tank. Hence the outlet concentration at any instant is the same as that of the material in the tank.

We now make use of Eq. (3).

$dI/d\theta$ = rate of input = 10 cfm.
$dO/d\theta$ = rate of output = 5 cfm.
Then $dA_e/d\theta$ = rate of accumulation = 5 cfm.

This total balance does not tell us much. Suppose we use the same equation for the salt.

$$dI_s/d\theta = 10 \text{ lb./min.}$$
$$dO_s/d\theta = 5c \text{ lb./min.}$$

where c = concentration of salt, lb./cu. ft.
Then $dA_s/d\theta = d(Vc)/d\theta = Vdc/d\theta + cdV/d\theta$
where V = total volume, cu. ft.
But the accumulation of total material $V = A_e$.
Then

$$dA_s/d\theta = A_e dc/d\theta + cdA_e/d\theta$$

or

$$10 - 5c = A_e dc/d\theta + cdA_e/d\theta$$

This is the differential equation relating c and θ. Another term, A_e, is present and must be eliminated when the equation is solved. The equation $dA_e/d\theta = 5$ will accomplish this.

Note our problem setup does not involve the original accumulation or the original concentration. These are initial or boundary values which will be used in solution.

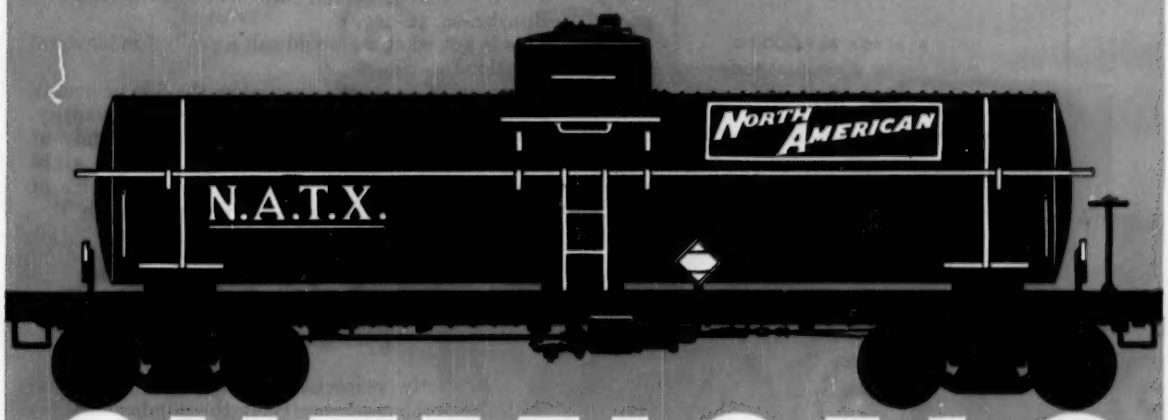
Problem 2—A large wooden storage tank initially contains 10,000 lb. of a 10% by weight solution of sodium chloride. A compressed air line, used occasionally for mixing the solution, leads to the bottom of the tank. By accident one night this air line is left open. A leak also develops near the bottom of the tank.

The solution leaks out at a rate of 1 lb./min. and the air flow is such that 1 lb. of water is evaporated per minute. Derive equations for the concentration of salt in the tank and the percent of the original salt remaining as a function of time.

Solution—We first draw a diagram as shown in Fig. 2. Now let S = salt in the tank at any time, lb.; W = solution in the tank at any time, lb.; θ = time, min.

We may now use Eq. (9) for both the salt and the total solution, since our word equation, minus

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The Basic Material Balance

Where inflow is zero

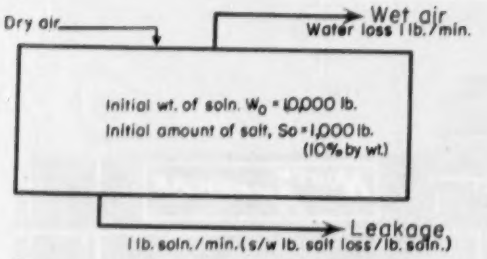


Fig. 2

output equals accumulation, is the same for both. For the total material we may write an integrated equation directly

$$W = 10{,}000 - 2\theta$$

For the salt

$$-(S/W)d\theta = dS$$

or

$$dS/S = -d\theta/W = -d\theta/(10{,}000 - 2\theta)$$

This equation, when solved, will give us a relationship between the pounds of salt remaining and time. Since W is known as a function of time, a simple division of S/W will give us the concentration.

How Basic Equations Apply to Heat Transfer

Certain basic equations arise in heat transfer, depending on the mechanism. We are accustomed to seeing these in integrated form; and sometimes fail to recognize their differential forms.

The fundamental equation for heat transfer by conduction is

$$dQ/d\theta = -kA\,dT/dL = q \qquad (11)$$

where

$dQ/d\theta$ = rate of heat flow, Btu./hr.
A = area, sq. ft.
dT/dL = temperature gradient, deg. F./ft.
k = thermal conductivity, Btu./hr.-ft.-deg. F.

We will not find this equation of much use as it stands. However, it does express Fourier's law and should be recognized as a basic equation upon which equations of unsteady state heat conduction are based.

When we consider heat transfer from a solid surface to a fluid, we know that convection equations will be used. If we assume heat transfer through a fluid or fluid film as being due to conduction, we write Eq. (11).

Taking a finite film thickness, ΔL, we write

$$q \text{ approximates } -(k/\Delta L)A\Delta T$$

Then, realizing that more than just conduction is involved, we might modify the equation by a correction F. We now write

$$q = -F(k/\Delta L)A\Delta T$$

Finally, we let $-Fk/\Delta L$ equal a new letter h or U, and write

$$dQ/d\theta = q = hA\Delta T \text{ or } UA\Delta T \qquad (12)$$

where

ΔT = a finite temperature difference, deg. F.
h or U = film or overall coefficient of heat transfer, Btu./hr.-sq. ft.-deg. F.

This is not what we would call a really fundamental equation.

In view of the above discussion, the film or overall coefficient is recognized as a correlated quantity. Actually, unit operations is a systematic study of these correlated quantities. These give the right answer with little real insight into the nature of the problem. There is nothing wrong with this approach, if we accept it as part of getting the job done.

For instance

$$\frac{1}{U_1} = \frac{1}{h_1} + \frac{LD_1}{kD_{av}} + \frac{1}{h_2}\frac{D_1}{D_2}$$

is a perfectly respectable equation. When faced with the problem of specifying the number of tubes in an exchanger, we estimate h_1 and h_2. Then we calculate U, choose the proper Δt, and eventually come up with a workable answer.

At best in getting h_1 and h_2, we use the Dittus-Boelter or Sieder-Tate or some other correlative equation, nomograph or set of tables. Much of the really fundamental work has been done. We refer the reader to a discussion of the derivation of the Nusselt equation as an example.

The fact that Eq. (12) is non-differential in nature does not mean that it is not useful in setting up differential equations. The equation states that at a given instant the heat flux is proportional to the area and driving force. During a process one or both temperatures, the area and the proportionality factor h or U may change.

Next, the basic equation for heat transfer by radiation is

$$dQ/d\theta = q = AF\sigma\Delta(T^4) \qquad (13)$$

where

σ = Stefan-Boltzman constant, 0.173×10^{-8} Btu./hr.-sq. ft.-(deg. R.)^4
F = factor to take geometrical relationships and deviations from black body behavior into account. Note that here again we have a finite driving force $\Delta(T^4)$.

When heat is transferred we do not measure this quantity as such. Instead we observe some quantity whose change is a measure of the heat transferred. Heat is energy in transit. When it reaches its destination it shows up as stored energy. Thus, a heat balance is in reality an energy balance.

As in the case of material balances, we may write the word equation

Input − output = accumulation

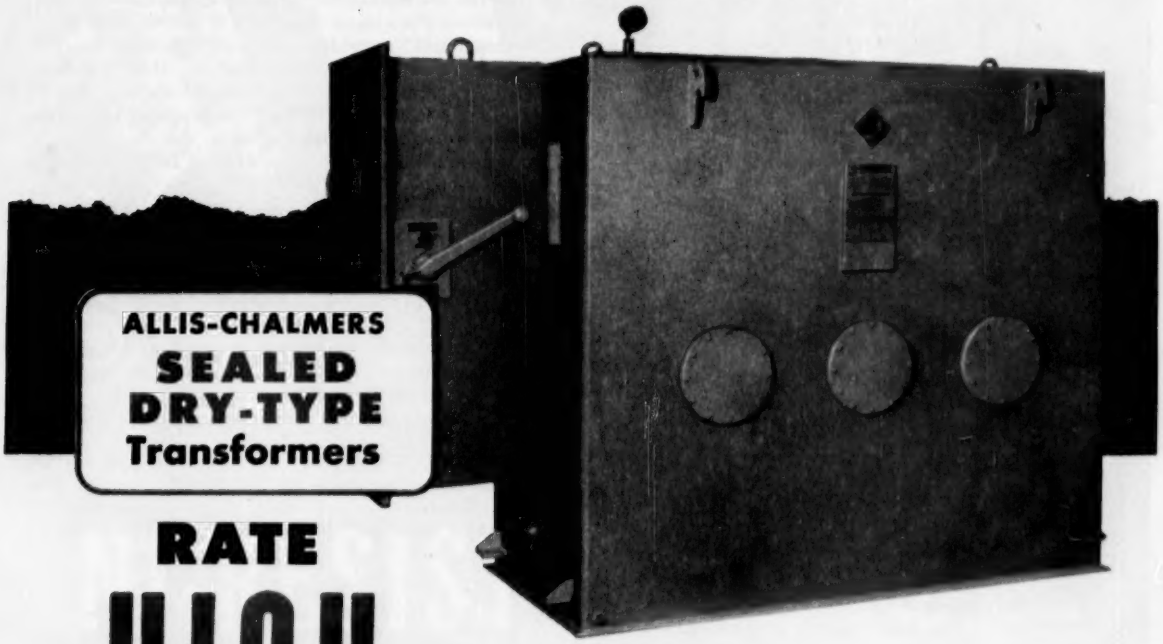
or

Rate of input − rate of output = rate of accumulation

The proper form of the energy balance to use is determined by the application of the first law of thermodynamics. Thus when heat is added to a

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The Basic Heat Balance

Where heat output is zero

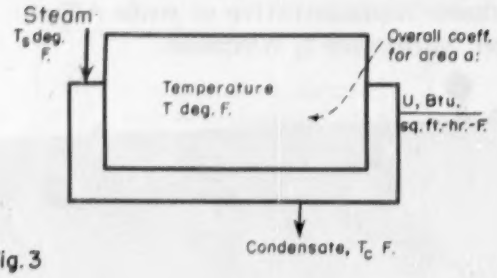


Fig. 3

system at constant volume, input equals accumulation.
Hence,

$$dQ = dE_t \tag{14}$$

assuming work effects are negligible. Here E_t is total internal energy in this equation. In turn, dE_t may be $Mc_v dT$ for sensible heat transfer, $(dM)\Delta E$ for a phase change or $(dM)\Delta E$ for a chemical reaction, all at constant volume.

Similarly for constant pressure batch (input equals accumulation) or in steady state flow (input equals output)

$$dQ = dH_t \tag{15}$$

where dH_t may be $Mc_p dT$ for sensible heat transfer or $(dM)\Delta H$ for a phase change or chemical reaction.

In these equations, using engineering units,

E internal energy, Btu./lb.$_m$
E_t total internal energy, Btu.
H enthalpy, Btu./lb.$_m$
H_t total enthalpy, Btu.
c_v heat capacity at constant volume, Btu./lb.$_m$
c_p heat capacity at constant pressure, Btu./lb.$_m$
dM mass changing phase or reacting, lb.$_m$

We could just as easily have used pound-moles as the unit of mass. The important thing is that the equations remain dimensionally consistent.

Problem 3—Consider a tank for batch heating a liquid. Heat is supplied by means of a steam jacket. The tank volume is V, cu. ft. The liquid has a density ρ, lb./cu. ft. and heat capacity c, Btu./lb.-deg. F.

The overall heat transfer coefficient is U, Btu./hr.-sq. ft.-deg. F., heated area is A, sq. ft. and temperatures of steam and liquid are T_s and T, deg. F., respectively.

Derive the equations for T as a function of time.

Solution—A simple diagram is shown in Fig. 3. We must next consider our assumptions. We will assume, in setting up the equation, that the tank is well stirred. Hence T is constant at any instant throughout the tank. When the problem is solved, other assumptions must be made.

Our heat balance assumes a word form (first law calculation)

Rate of input − rate of output = rate of accumulation
Rate of input = $UA(T_s - T)$
Rate of output = 0
Rate of accumulation = $d(V\rho cT)/d\theta = V\rho d(cT)/d\theta$

Next we check the proposed equation for dimensional consistency and find that the result gives Btu./hr. Thus, the equation is

$$d(cT)/d\theta = (UA/\rho V)(T_s - T) \tag{16}$$

Note that we have removed ρV from the derivative because the mass of the liquid remains constant. We have no guarantee that the heat capacity c remains constant. In the usual case c is assumed constant, and

$$dT/d\theta = (UA/\rho cV)(T_s - T) \tag{17}$$

The term $dT/d\theta$ is obviously a rate. The term $(UA/\rho cV)(T_s - T)$ is also a rate. When rate constants such as U, h, k_s, k_a, etc. are present, a non-differential term represents a rate.

Problem 4—One end of a long thin iron rod is at t_s F. The rod projects into air at a temperature of t_a F. What is the equation that defines the steady-state temperature distribution along the rod?

Solution—We first draw and label a diagram as shown in Fig. 4. The next step in the solution consists of making an energy balance around an arbitrary slice of the rod dx thick.

We will assume that the properties of the rod are independent of temperature. Also that the rod is thin enough so that there is no temperature variation perpendicular to the length of the rod.

The energy balance is stated: input minus output equals accumulation. To find what to substitute for each of these words, let us first consider the input term only. Since the input is from conduction only when t_s is larger than t_a, we can say that

Input = $(dQ/d\theta)_{in} = -kA(dt/dx)_x$ (11) where Q = energy, Btu.; θ = time, hr.; k = thermal conductivity of the rod, Btu./hr.-ft.-deg. F.; A = cross sectional area of the rod, sq. ft.; t = temperature of the rod, deg. F.; x = distance from the end of the rod, ft. and $(dt/dx)_x$ = temperature gradient at the point x, deg. F./ft.

However, the output term is not this simple. It consists of two parts, that due to conduction away from our arbitrary slice and that due to loss of energy to the surrounding air. Thus,

Output = $(dQ/d\theta)_{out} = -kA(dt/dx)_{x+dx} + hA_s$

The Basic Heat Balance

Steady-state temperature distribution

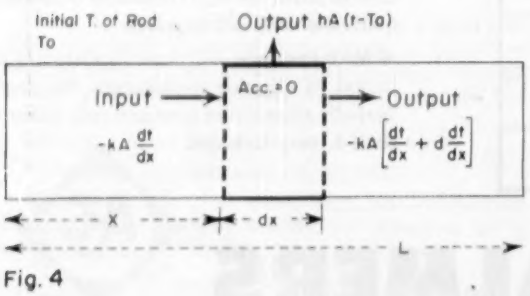


Fig. 4



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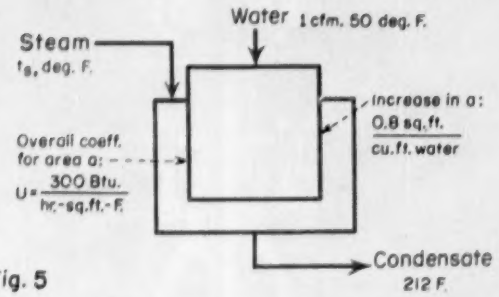


Fig. 5

$(t - t_s)$ where h = surface film coefficient, Btu./hr.-sq. ft.-deg. F. and A_s = surface area of the rod contained between x and $x + dx$. Note that here we have assumed that dx is so small that t does not change appreciably throughout the slice.

Since the problem involves steady state only, the temperature can not change with time. Hence the accumulation term must be zero. The energy balance now becomes

$$-kA(dt/dx)_x-[-kA(dt/dx)_{x+dx}+hA_s(t-t_s)]=0$$

To make this equation really useful, however, we must relate the two terms $(dt/dx)_x$ and $(dt/dx)_{x+dx}$ to some common basis. This can be done by noting that

$$(dt/dx)_{x+dx}=(dt/dx)_x+d(dt/dx) \qquad (18)$$

where $d(dt/dx)$ is the change in the gradient as we move from the point x to the point $x + dx$. Since $dx/dx = 1$, $d(dt/dx) = (d^2t/dx^2)dx$. Therefore:

$$(dt/dx)_{x+dx}=(dt/dx)_x+(d^2t/dx^2)dx \qquad (19)$$

and the energy balance becomes

$$kA(d^2t/dx^2)dx-hA_s(t-t_s)=0 \qquad (20)$$

Even Eq. (20) is not the simplest form of the equation, since $A_s = Pdx$ where P is the perimeter of the rod in feet. Using this relationship and dividing both sides of Eq. (20) by $kAdx$ gives

$$(d^2t/dx^2)-(hP/kA)\,(t-t_s)=0$$

or

$$(d^2t/dx^2)-\lambda^2(t-t_s)=0$$

where $\lambda^2 = hP/kA$

Note that t_s is a constant. Thus its derivative is zero. Letting $T = (t - t_s)$ the equation becomes

$$d^2(T+t_s)/dx^2-\lambda^2T=0 \text{ or } d^2T/dx^2-\lambda^2T=0 \qquad (21)$$

The temperature distribution in the rod is now described by Eq. (21). It is in a form that is readily solved. We will not consider the actual solution at this time.

Problem 5—Initially a cylindrical tank five feet in diameter contains 10 cu. ft. of water at 212 F. The tank is heated by means of a steam jacket with the steam condensing at 212 F. Water at 50 F. is then introduced at a constant rate of 1 cfm. As water is added, the surface available for heat transfer increases at the rate of 0.8 sq. ft./cu. ft. water.

What is the average water temperature as a function of time? Consider the tank well agitated so that temperature of the water is uniform. Assume the overall heat transfer coefficient U is constant at 300 Btu./hr.-sq. ft.-deg. F.

Solution—A simple diagram of the system is shown in Fig. 5. Notice that in this problem there are two basic factors that are changing continually. These are the total mass and the total energy of the water in the tank.

We conclude that both a material balance and an energy balance will be required to describe the system. If we let W = flow rate of water, V = volume of water in the tank, θ = time, t_w = temperature of the incoming water, t_s = steam temperature and T = temperature of water in the tank at any time. When a numerical solution is to be obtained, all units must be consistent.

The material balance is then $Wd\theta - 0 = dV$ and the energy balance is

$$Wc_p\rho t_w d\theta+UA(t_s-T)d\theta-0=d(Vc_p\rho T)$$

We now have two equations. The first relates the volume of water in the tank to time. The second relates the volume, temperature and time. Our problem is to find the temperature as a function of time. We must now combine these two equations to produce one equation that is a function of the two desired variables, temperature and time, only.

First, integrate the material balance to solve for the total volume in the tank,

$$\int_0^\theta Wd\theta=\int_{V_s}^{V}dV$$

or $W\theta = V - V_s$. Now substitute V into the energy balance

$$Wc_p\rho t_w d\theta+UA(t_s-T)d\theta=d[c_p\rho T(V_s+W\theta)]$$

However, the area factor in the second term is also a function of volume and must be converted to a function of time.

$$A=0.8V=0.8(V_0+W\theta)$$

The energy balance finally becomes

$$Wc_p\rho t_w d\theta+0.8\,U(V_s+W\theta)\,(t_s-T)d\theta=d[c_p\rho T(V_0+W\theta)]$$

Assume now that c_p and ρ are independent of the temperature. Divide above equation by $Wc_p\rho d\theta$.

$$Wt_w+(0.8\,U/c_p\rho)\,(V_s+W\theta)\,(t_s-T)=(V_s+W\theta)dT/d\theta+WT$$

Let $0.8U/c_p\rho = a$. Then substituting in the equation gives

$$\frac{dT}{d\theta}+\left[\frac{W}{V_s+W\theta}+\alpha\right]T=\left[\frac{W}{V_s+W\theta}\right]t_w+\alpha t_s \qquad (22)$$

This is the differential equation relating the average temperature of the water in the tank to the time. We will consider the solution later.

REFERENCES

1. Bridgman, P. W., "Dimensional Analysis" (Revised Edition), Yale University Press, New Haven (1954).
2. Coulson, J. M. and J. F. Richardson, "Chemical Engineering" (Vol. I), McGraw-Hill Book Co., Inc., New York (1954).
3. Langhaar, H. L., "Dimensional Analysis and the Theory of Models," John Wiley & Sons, Inc., New York (1951).
4. McAdams, W. H., "Heat Transmissions" (3rd. Edition), McGraw-Hill Book Co., Inc., New York (1954).
5. Mickley, H. S., T. K. Sherwood and C. E. Reed, "Applied Mathematics in Chemical Engineering," McGraw-Hill Book Co., Inc., New York (1957).
6. Pierce, J. E., "Put Dimensional Analysis to Work," *Chem. Eng.*, Apr. 1954, pp. 185-190.

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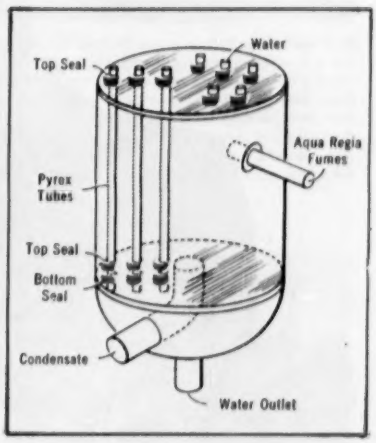
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Seals still in use after 13 months exposure to corrosive fumes at a rate of 3000 cu. ft./min.

A new tube-type heat exchanger is used in a precious metals refining process by the J. Bishop & Co. Platinum Works of Malvern, Pa. The cooler in this unit contains 1,275 Pyrex tubes each ⅜ in. diameter and 10 ft. long. Water circulated through the tubes condenses the 125° F. aqua regia fumes which are passed into the cooling chamber through 2 large gas dampers. The cooling rate is 3000 cu. ft./min.

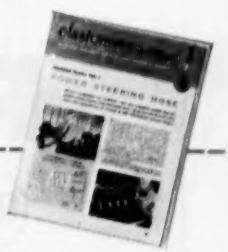
Each tube has 3 annular seals of Du Pont HYPALON. These seals—resilient enough to permit thermal expansion of the glass tubing—keep water out of the fume chamber; prevent leakage of aqua regia. Few chemicals are more corrosive than aqua regia, yet these seals of HYPALON have been in service over 13 months without a failure.

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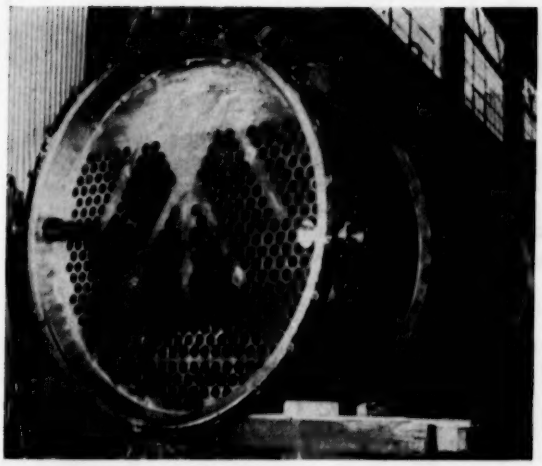


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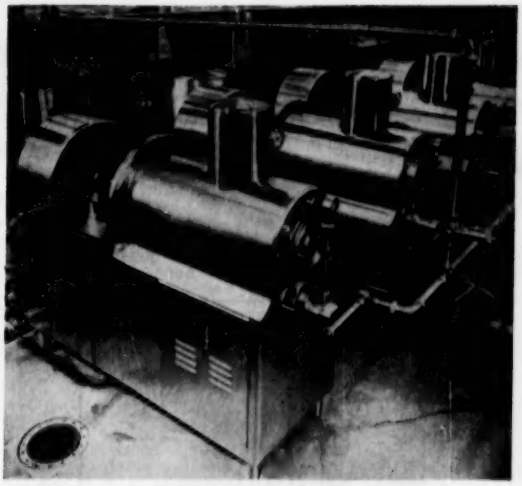
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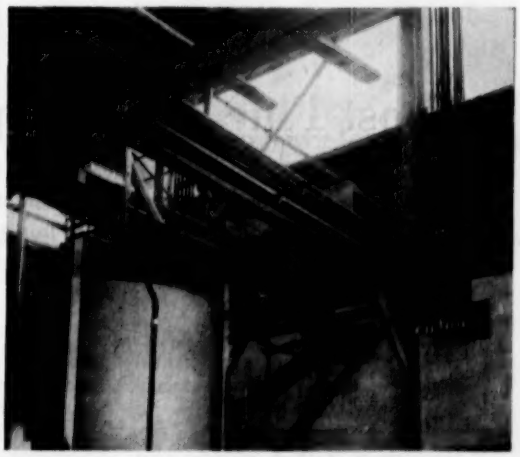
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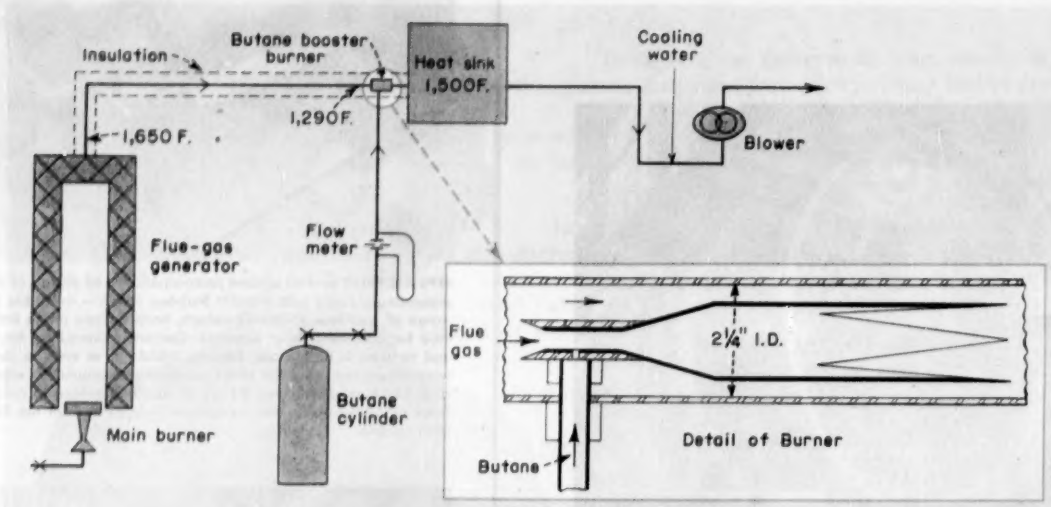
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Boost Flue Gas Temperatures With Butane

An experimental installation heated with flue gas needed a 200 F. boost. Here's how to do it.

★ Winner of June Contest by
Howard W. Hill
Research Dept., Western Div., Dow Chemical Co., Pittsburg, Calif.

As part of an experimental program we needed to heat certain equipment gradually to 1,500 F. by pulling hot flue gas through it with a water-cooled blower. The furnace supplying the flue gas operated at 1,650 F. but even with heavy insulation we calculated that the flue gas would drop in temperature to 1,235 F. during its flow to the heat sink. Also, available pressure drop prevented drawing more than 25 scfm. of hot gas so that it became clear that auxiliary heat would be needed.

Piping from the furnace to the heat sink was a 2¼-in. I.D. No. 316 stainless steel tube, suitable for use up to 1,650 F. Available experimental data indicated that near stoichiometric ratios of butane and air would ignite spontaneously from a hot wall at 1,235 F., provided that the mass velocity was below 600 lb./(hr.)(sq. ft.). If ignited, the gas would burn in a very short length of passage in the 11%-O_2 flue gas.

However, in this case we determined the mass velocity at about 4,200, which would require much higher temperatures for spontaneous ignition. Slowing the gas down would not help since the resultant much greater heat loss would then cool it to a much lower temperature. Even if a combustible mixture could be ignited, the resultant tem-

---

NEXT MONTH: Safer Loading Station Is Easier to Use
By Paul C. Ziemke, Winner of the July Contest

★ How Readers Can Win

$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for the Plant Notebook.

Each month's winner will be announced in the issue of the second following month, and published the third following month.

$100 Annual Prize—At the end of each year the monthly winners will be rejudged and the year's best winner awarded an additional $100.

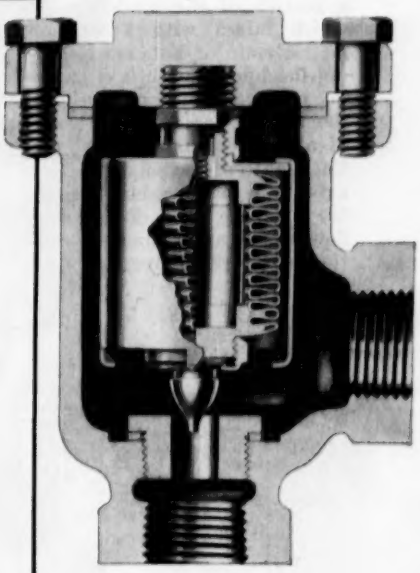
How to Enter Contest—Any reader (except McGraw-Hill employees) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable non-winning articles will be published at space rates ($10 min.).

Articles may deal with plant or production "kinks", or novel means of presenting useful data, of interest to chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

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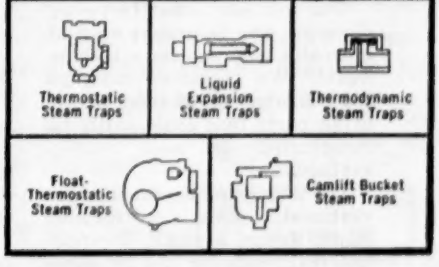
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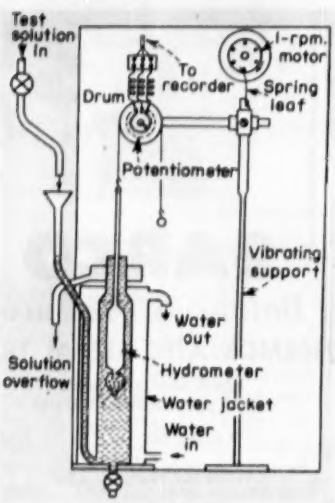
perature would go completely out of control.

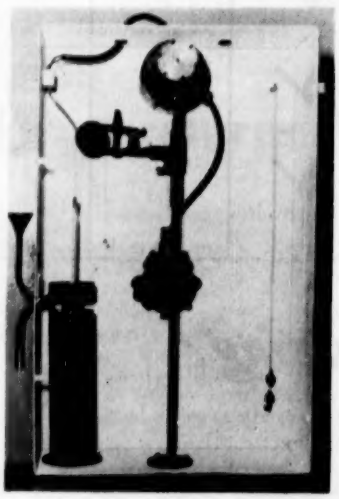
The solution to this problem lay in the butane booster burner shown in the sketch. The burner, installed within the 2½-in. I.D. pipe, consists of an axial tube having an upstream area about 5% of the pipe area. This passes a portion of the total flue gas which mixes with a stoichiometric ratio of butane. Following the inlet section is a diverging cone calculated to decelerate the mixture to a mass velocity of about 600 lb./(hr.)(sq. ft.). The length of the small-diameter axial tube was selected so that the pressure drop of the small flow would approximately equal that of the remaining gas in the annular passage outside the large-diameter cylinder following the diverging cone.

The idea was that the decelerating combustible mixture inside the cone would ignite and burn when it reached the proper velocity for the wall temperature. In this case, of course, the wall of the burner would not be cooled by insulation losses. A 2-in. length of the larger cylinder was provided to give time for combustion. Then, to allow for gradual mixing and deceleration of the gas outside the cylinder, we cut the thin-wall tubing into 4-in. long serrations.

Calculation showed that the resulting temperature would be well above the recommended temperature for stainless steel. However, we expected a reasonable metal temperature owing to a high external film coefficient at high velocity. In operation the mixture would not ignite at 1,235 F. By exceeding the recommended temperature in the flue gas inlet and bringing the flue gas to the burner at 1,290 F., the butane ignited spontaneously and the equipment heated up smoothly to a final temperature of 1,510 F.

It developed that butane consumption was twice what had been calculated, indicating combustion to CO rather than CO_2. Inspection after operation showed no overheating damage to the burner.





Density Recorder Measures Continuously

G. Homberg
Société des Produits Chimiques Courrieres-Kuhlmann Harnes Plant, France.

One of our manufacturing divisions was in urgent need of a density recorder for a flowing liquid. We therefore designed the instrument illustrated above, using parts that could easily be constructed or were readily available.

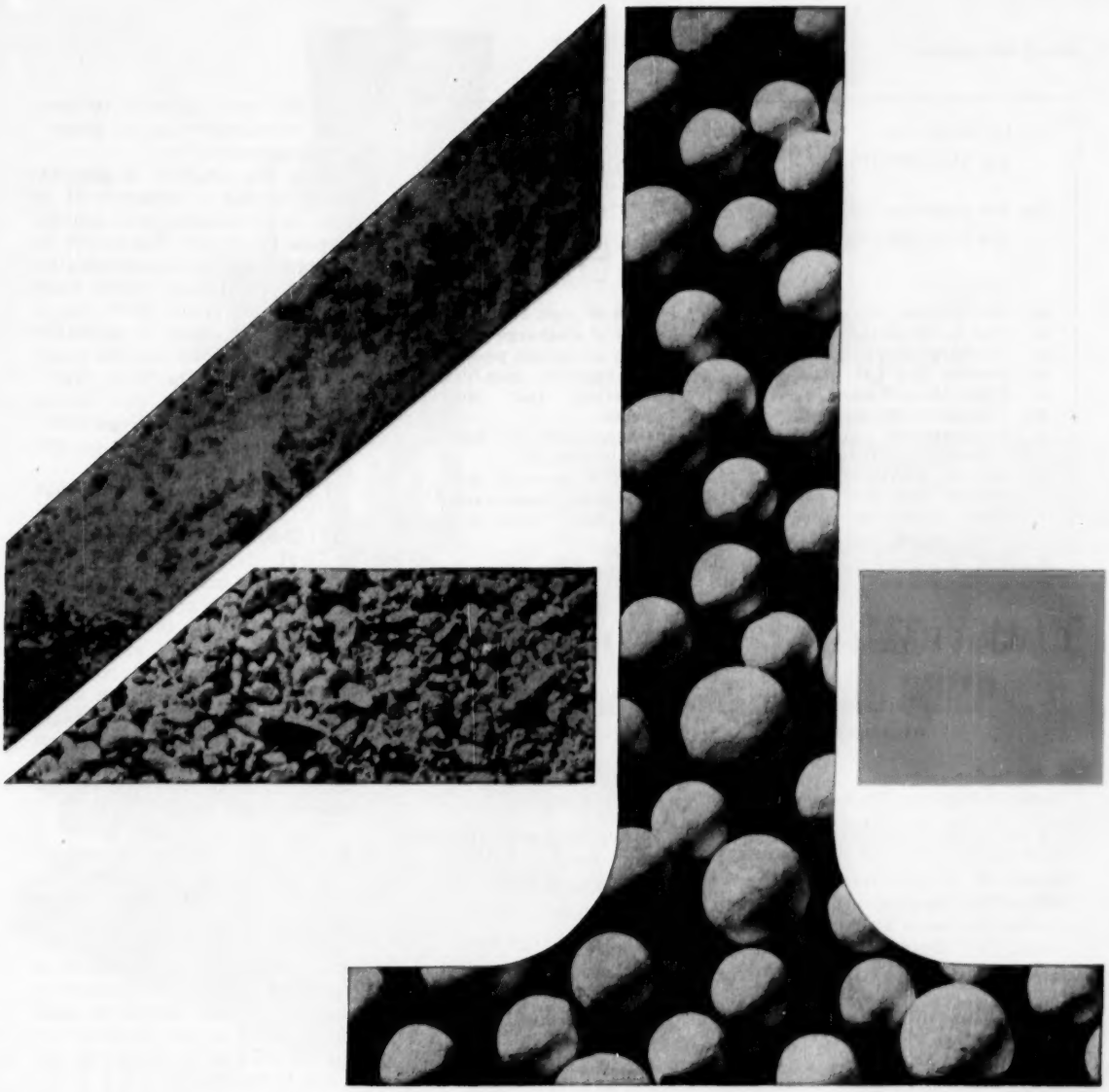
The measuring device is a conventional glass hydrometer which drives a small, low-friction potentiometer of 0-200 ohms capacity. The hydrometer vessel is surrounded by a constant-temperature water bath to insure constant sample temperature. The sample itself is a small, continuous side stream diverted from the process, which enters the hydrometer vessel at the bottom and continuously overflows at the top.

The potentiometer, or rheostat, is driven by a fine wire running over an ebonite drum, one end of the wire being attached to the stem of the hydrometer, and the other to a light counterweight. The drum is hollowed out, to be as light as possible, with its diameter chosen to give a convenient relation between the scales of the hydrometer and the recorder available for this use.

Despite the small amount of energy required to drive the moving contact of the potentiometer, some method is needed to insure accurate positioning of the contact in the event of small changes in density. This was provided by vibrating the potentiometer every 10 sec. The potentiometer is carried on an arm supported on top of a long, flexible metal tube. A spring leaf at the top of the tube makes contact every 10 sec. with a projection on a disk rotated at 1 rpm. by a small gear-motor. At each contact the supporting tube is moved sidewise, then released and jolted gently.

Height of the hydrometer float is detected continuously by the angular position of the potentiometer contact. The potentiometer is connected into two arms of a self-balancing bridge circuit, the balance position being recorded in terms of density on a graphic chart.

Sensitivity of this instrument is practically equal to that of the hydrometer float itself.



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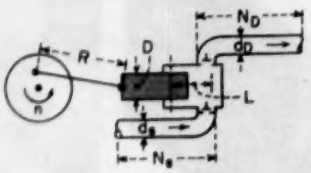
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For the supply line:

$$\Delta H > (Qn/284)(N_s\, d_s^2)$$

For the discharge line:

$$\Delta H > (Qn/189)(N_D/d_D^2)$$



a	Acceleration, ft./sec.^{2}	N	Length of pipe, ft.
d	Pipe inside diameter, inches.	N_D	Length of discharge pipe, ft.
d_D	Discharge line I.D., inches.	N_s	Length of suction pipe, ft.
d_s	Suction line I.D., inches.	Q	Pump capacity, gpm./cyl.
D	Pump plunger diam., inches.	R	Connecting rod length, inches.
E_v	Volumetric efficiency, %.	ΔH	Discharge level less highest supply level, ft.
g	Gravitational conversion factor, 32.2 ft./sec.^{2}	ΔP	Pump diff. pressure, psi.
G	Specific gravity.	$>$	Means here "must exceed."
H_i	Inertia head, ft.	$<$	Means here "must be less than."
L	Pump stroke, inches.		
n	Pump speed, rpm.		

Choose Pipe Size to Avoid Overfeeding

With low head, batch proportioning pumps may overfeed due to inertia. Here's how to avoid it.

J. R. Hefler
Research Engineer, Proportioneers, Inc., Providence, R. I.

Last month we discussed three important aspects of the installation of proportioning pumps which feed against near-atmospheric discharge to batch processes. We found that certain definite rules must be followed if accuracy is to be achieved and noted also that overfeeding is possible due to the inertia of liquid in the line unless the line is of proper diameter in relation to its length.

To determine the necessary relationships we can start with the basic equations for inertia head H_i and maximum liquid acceleration a_{max}:

$$H_i = N(a/g)$$

$$a_{max.} = \left(\frac{Ln^2}{2{,}185}\right)\left(\frac{D}{d}\right)^2(1 \doteq L/2R)$$

From these, and the expression for the capacity of a reciprocating pump in gpm. per cylinder, $Q = D^2LnE_v/294$, we get:

$$a_{max.} = \frac{Qn}{7.43\, E_v d^2}(1 \doteq L/2R)$$

and

$$H_{i\,max.} = \frac{NQn}{239\, E_v d^2}(1 \doteq L/2R)$$

If we assign typical values of 0.2 to $L/2R$ and 0.95 to E_v, then for a simplex pump at atmospheric discharge:

For the supply line

$$\Delta H > (Qn/284)\,(N_s/d_s^2) \qquad (1)$$

For the discharge line

$$\Delta H > (Qn/189)\,(N_D/d_D^2) \qquad (2)$$

For a symmetrical duplex pump with common lines for atmospheric discharge:

$$\Delta H > Qn/284\,(N_s/d_s^2 + 1.5\,N_D/d_D^2) \qquad (3)$$

For a low-pressure system the value

$$2.31\Delta P/G + \Delta H$$

must exceed Eqs. (1), (2) or (3).

For various lengths of supply and discharge runs the equations given determine the correct pipe sizes to avoid overfeeding with the static heads, pump capacities and speeds of typical designs.

A high-speed pump will require a larger pipe size for a given length of line, delivery rate and pump differential, than a slow-speed pump of the same general design. Since the high-speed pump will generally have a smaller cylinder and pipe connections, it follows that the pipe size required for an installation ought frequently to be larger than the pump cylinder connections when operating at atmospheric pressure.

Take for example a simplex pump having a capacity of 8 gmp. at 96 strokes/min. Let us assume the supply line length is negligible and the pump operates against a minimum static head of 15 ft. of liquid. How long a run of 2½-in. pipe is allowable between the pump and the point of discharge? The term "run" is taken to mean the entire length of line and fittings down the center line of the pipe, regardless of direction.

Using Eq. (2) we find that $N_D < 189\,\Delta\, Hd_D^2/Qn$, or $(189)(15)(2.5)^2/(8)(96)$. Hence $N_D < 23$ ft.

Since the maximum total run is 23 ft. and the rise above the pump is 15 ft., the maximum horizontal offset distance between the pump and point of discharge can only be 8 ft. using a conventional piping arrangement. If a straight, sloping run is used, the maximum horizontal offset of the pump from the discharge point is about 17½ ft.

This gives an indication of the degree of limitation encountered in spacing the pump and supply tank close to the process mixer or point of discharge. To correctly solve problems of this kind, where the pump cannot be installed within this distance, a larger size line should be used, or a small surge chamber can be installed in the discharge line close to the pump.

A large surge chamber should not be used with an automatic batching pump since changes in liquid volume in the chamber would introduce an error in liquid delivery from batch to batch. For continuous, rather than batch, processes the surge chamber is a satisfactory means of preventing overfeed due to inertia in undersize discharge lines.

In some cases the method used to operate with long discharge lines is to load the line with a back-pressure valve. This is the cheapest solution but not a completely satisfactory or reliable one. The valve is subject to incessant operation, opening and reseating under spring pressure many times a minute. When open, the lift is small compared



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WRITE FOR BULLETIN 440 ***with typical applications, flow charts, description and specification of models of various capacities and constructions. Inquiry Data Sheet included from which we can make specific engineering recommendation for your processing requirement. Write Lapp Insulator Co., Inc., Process Equipment Div., 375 Poplar St., Le Roy, N. Y.***

Lapp

to a normal check valve and there is a high velocity of liquid which erodes the valve and seat. As a result the valve is apt to become scored and leak. If so, it will fail to impose a static back pressure at very low rates of flow.

The required action is for this valve to decelerate the entire column of liquid in the discharge line at a rate equivalent to that at which the plunger decelerates. At the very end of the discharge stroke when this deceleration must be greatest there is but very little flow. It is likely that the spring-loaded valve will act erratically and leak a slight excess of liquid at each stroke, causing unreliable performance.

This might come about, for example, in feeding a softening oil whose viscosity changes with temperature. With back-pressure valve leakage, the same batch setting would give too large a quantity during periods of high temperature and low viscosity. If the setting were then readjusted to give the required feed under those conditions, then the delivery will be too small when liquid viscosity increased at lower temperature.

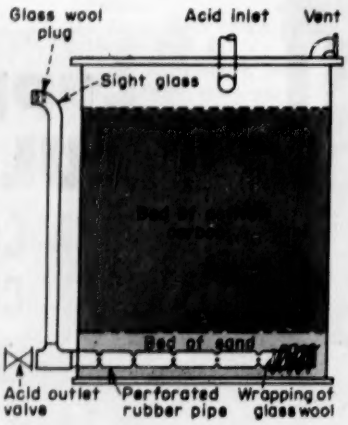
When a back-pressure valve is used, its proper location is at the discharge outlet, never at the pump. A column of liquid can be held back by pressure from a point ahead, but it does not necessarily come to rest in an open line when a valve is closed behind it. In the latter case, the maximum decelerating force is the difference between atmospheric pressure and the vapor pressure of the liquid.

A further point to consider which is frequently overlooked in back-loading a pump is the increased power requirement. The pump drive must overcome a peak load during the discharge stroke due to static pressure plus friction and inertia in starting the liquid column in motion. These forces in the case of liquids in viscous flow come to a peak just before midstroke, when the mechanical advantage of the crank is at minimum.

Such dynamic forces, plus the artificial back-loading imposed on the pump, frequently exceed the rating of very light duty pumps, causing either an electrical or a mechanical overload.

A pressure gage on the pump cylinder will register this peak pressure load. It is not uncommon for the dynamic and artificial loading to produce a pressure several times greater than the gravity differential or pump static head. It would be unfortunate if the pump were selected with only the low static differential head in mind.

It is obvious that an undersize line not only jeopardizes the accuracy but the mechanical life of the pump. Though resort to a back pressure device is of temporary value in restoring accuracy, it can only increase pumping load and give increased maintenance and power need.



Simple Filter Bleaches Muriatic Acid

Paul N. Cheremisinoff
Chemical Engineer, Dumont, N. J.

Muriatic acid often has a yellow color and sediment, either as received or acquired after standing in storage. The filter diagrammed above will remove the color and sediment and produce a clear, water-white product if desired.

A rubber-lined tank, round or rectangular, is fitted with connections and piping as in the diagram. The external connections are of flanged industrial glass pipe with rubber gasketing. The pipe for the discharge is of 2-in. hard rubber, perforated with four rows of ¼-in. holes, spaced 90° apart and 1 in. between holes. One end is sealed with a rubber plug or stopper.

The lower part of the tank contains a bed of iron-free, 45-mesh sand to support the filter bed. To prevent it from entering the holes in the outlet pipe, the latter is wrapped in commercial glass wool. Glass wool is also used to seal the top of the sight glass so as to prevent dust from entering the system. The active filtering medium is 10-20 mesh granular activated carbon.

The equipment can be made any size needed to fit individual requirements. Its size can also be adjusted to give the desired flow rates. The life of the filter medium depends, of course, on the material filtered and on the end product desired. However, experience has shown that a filter of this type will remain active for quite long periods of time without the need for recharging with new active filtering material. It will handle a great deal of acid before becoming inactive.

Shellac Solutions Are Good Rust Preventers

Ved Swarup Gupta
Indian Lac Research Institute
Namkum, Ranchi, India.

A thin shellac solution, we have found during our studies of shellac film properties, is an excellent rust preventive for iron and steel. A 10% solution of shellac in alcohol (methylated spirit) dries to a thin film which will protect against atmospheric corrosion for at least a year. A similar solution prevents tarnishing of copper and brass. A gallon of such a solution will cover about 1,000 sq. ft.

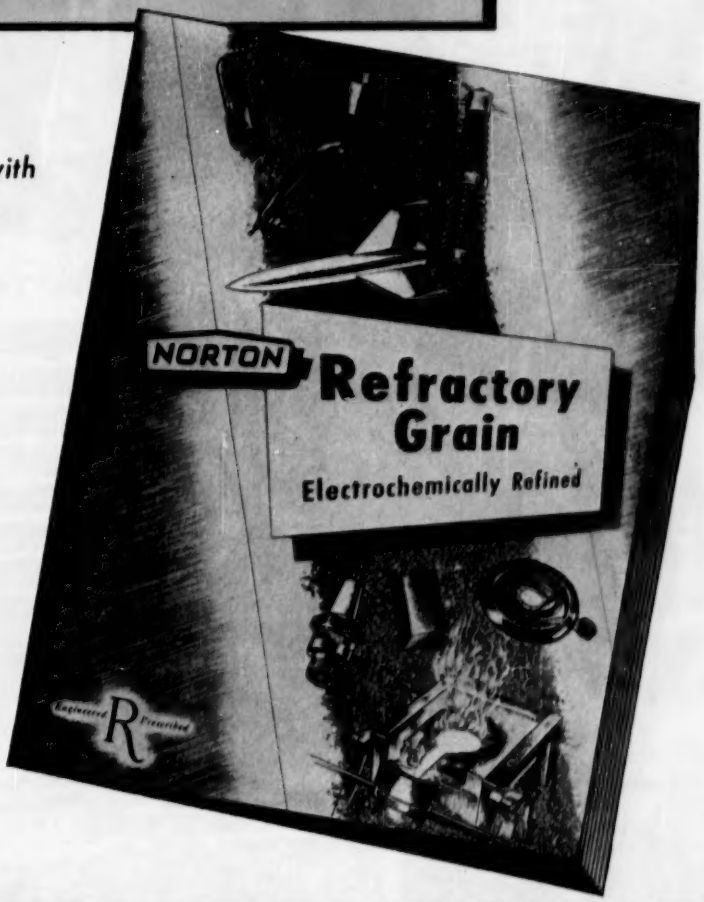
In addition to giving effective protection, the lac film is easily removed by wiping with cotton waste wet in methylated spirit. For a non-removable glossy coating, solution of dewaxed lac in alcohol is preferred.

You May Profit From This Book

✓ *if you are concerned with processing that involves temperatures ranging upwards to 4000°*

✓ *if your progress in processing depends upon materials of high purity.*

✓ *if it would help you to obtain a modern material with unusual electrical characteristics.*



Here is a valuable reference book that tells you all about the chemical and physical characteristics of such materials as CRYSTOLON* Silicon Carbide, ALUNDUM* Aluminum Oxide, MAGNORITE* Magnesium Oxide, Fused Zirconia and Boron Carbide.

Describing how these electrochemically refined materials react under varying conditions, this book gives you plenty of facts on materials that are helping to solve processing problems.

Get this useful help towards solving your own processing problems. Write today for your free copy of "Norton Refractory Grain." NORTON COMPANY, Refractories Division, 509 New Bond Street, Worcester 6, Mass.

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Engineered... Rx ...Prescribed

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
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Westinghouse motors double normal life for this application

. . . at Ohio-Apex Div., Food Machinery and Chemical Corp.

this standard *Life-Line A* motor still pumping corrosive POC I_3 after 12 continuous months without maintenance or down time.

"We must have a dependable motor, completely sealed and corrosion-resistant," says Mr. Burton Fitch, Ohio-Apex Division of Food Machinery and Chemical Corporation, Nitro, West Virginia. "A corrosive atmosphere, plus phosphorous oxychloride drip and seepage, cuts motor life. Westinghouse Life-Line® "A" motors have already passed this replacement point twice . . . and are still going strong."

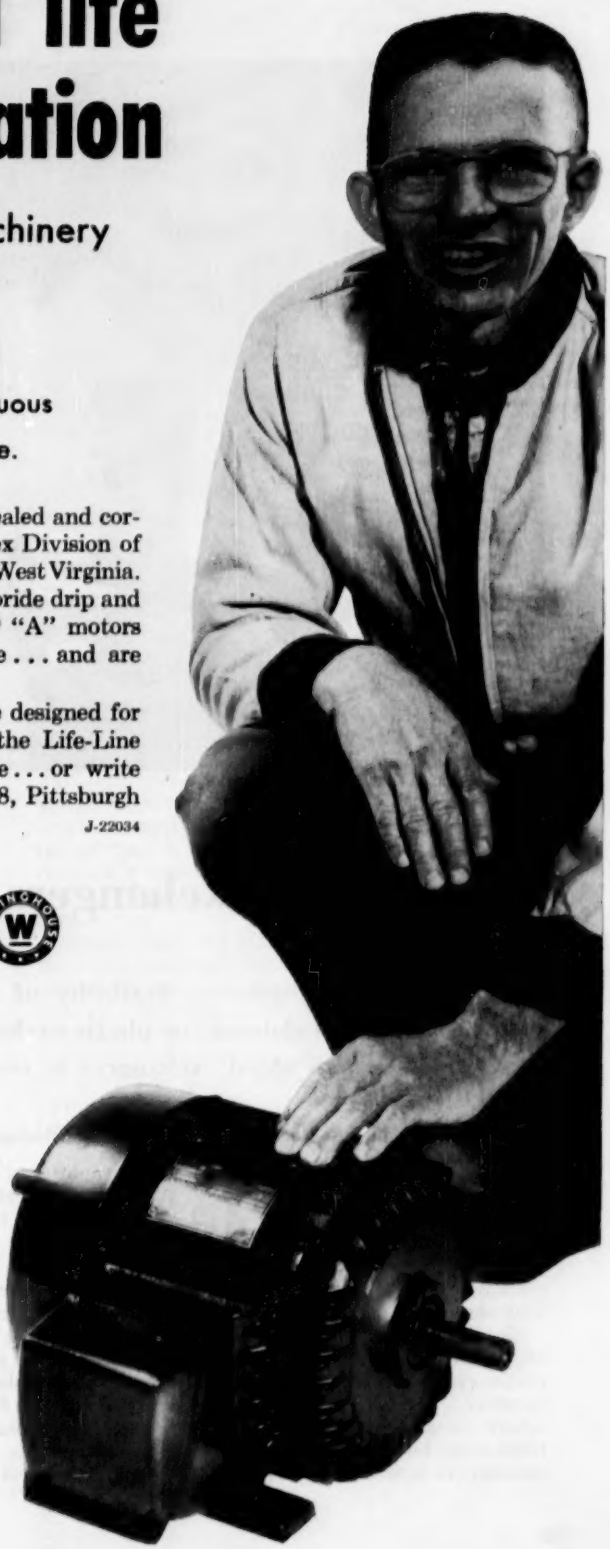
Westinghouse motors last longer because they're designed for modern industry's needs. For more facts about the Life-Line "A", call your local Westinghouse representative . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-22034

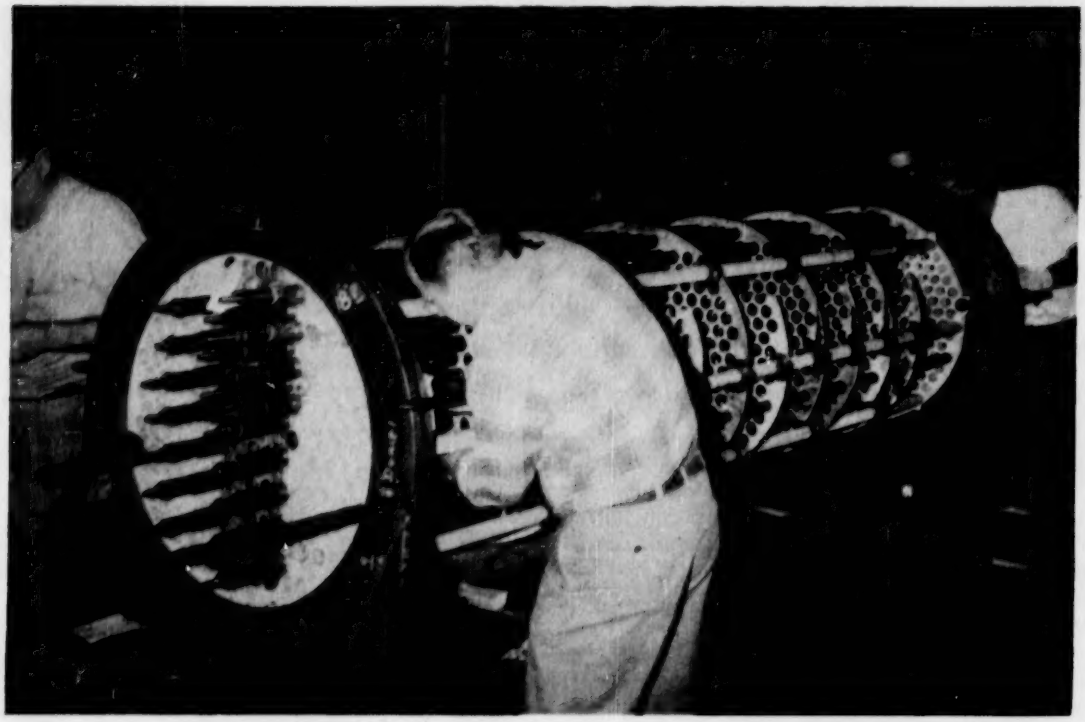
YOU CAN BE **SURE**... IF IT'S

Westinghouse

"Westinghouse Life-Line "A" motors have cut our motor costs substantially . . . helped us keep our chemicals moving down the line," says Mr. Fitch of Ohio-Apex. "Their built-in ruggedness, plus foolproof sealing against corrosion, means longer life, lower maintenance."



Unretouched photo of Life-Line "A" three-hp motor driving chemical pump at 1730 rpm, 100 gpm at Ohio-Apex.



Plastic Heat Exchangers Gain in Severe Service

Corrosion resistance, flexibility of design, low cost are advantages claimed for plastic exchangers. They are competing with metal exchangers in severe service.

D. M. Whitley, Chief Engineer, Haveg Industries, Wilmington, Del.

Resistance to corrosion and standard units at relatively low cost—these are advantages offered by plastic heat exchangers. This heat exchange equipment can employ plastic shells, baffles, tube sheets and tubes.

Metals are most often associated with the fabrication of heat exchangers. More and more however, plastic is specified where severe corrosive conditions must be met. Most plastic exchangers now consist of plastic (graphite or glass) tubes, and plastic tube sheets and channels to handle tubeside corrosives, with steel shell and steel baffle assemblies.

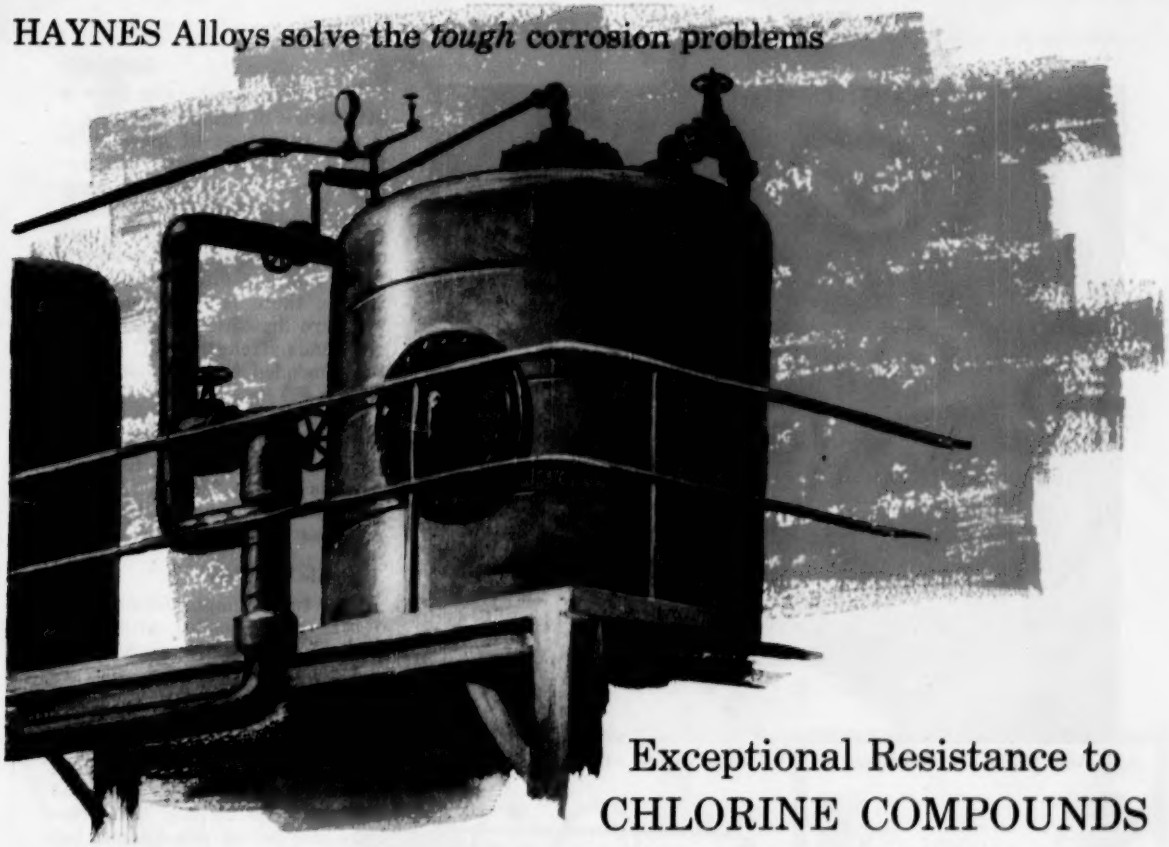
But good water is becoming increasingly scarce. Thus brackish water and sea water are coming into use for process cooling. Plastic materials are increasingly demanded for the fabrication of heat exchanger shell and baffle assemblies.

Materials most often used in the shell and baffle assemblies of heat exchangers are asbestos filled phenolics and furans. Epoxy glass, polyester glass, or PVC-lined steel are also becoming important.

The various plastic formulations for tubeside and shellside construction are resistant to practically all acids, bases and salts, to chlorine and to many solvents and other chemicals except those of a highly oxidizing nature.

Also, plastics withstand severe chemical cleaning. In the case of most metal construction, this cleaning process would require buffering or careful inhibiting. But plastics will withstand a long cleaning period with concentrated acid or alkali solutions.

HAYNES Alloys solve the *tough* corrosion problems



Exceptional Resistance to CHLORINE COMPOUNDS at 300 deg. F.



Built-In Corrosion Resistance—Sections of 11-gage HASTELLOY alloy C sheet are welded to the interior of a vessel to protect it from attack by HCl and chlorine compounds.

A large preheater lined with HASTELLOY alloy C is giving exceptional service while operating under severely corrosive conditions in a chemical plant. Used in the production of benzene hexachloride, the lined vessel resists the attack of hydrochloric acid, trichlor benzene and other chlorine compounds at 300 deg. F. temperatures.

Vessels lined with HASTELLOY alloy C have been used for this application for two to four years. It has been estimated that, with periodic maintenance, the nickel-base alloy will last almost indefinitely.

A recently published booklet describes the corrosion-resistant characteristics of HASTELLOY alloys. Send for your free copy. Write Haynes Stellite Company, Distribution Section, 30-20 Thomson Avenue, Long Island City, N. Y.

HAYNES ALLOYS

HAYNES STELLITE COMPANY

Division of Union Carbide Corporation

Kokomo, Indiana

UNION CARBIDE

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GLASS tubes are assembled to PVC tube sheets with rubber ferrules.

Improved Sealing Methods

The first exchanger units made generally consisted of plastic tube sheets tubed with glass or impervious graphite. Closure between tubes and tube sheets was made with rubber stoppers, or with stuffing-box type arrangements.

This type of closure was superseded as the ability to cement plastics was effectively developed. With this improvement in resin cements, it becomes practical to cement impervious graphite to the plastic tube sheet, producing a unit with a positive seal between tube and tube sheet. However, some special applications still call for sealing impervious graphite tubes with a flexible packing material and in the glass-tubed chlorine coolers, rubber stoppers are still the practical system.

In the standard exchangers, use of cement rather than rubber stoppers results in a greater heat transfer surface for a given shell diameter and length—a tighter tube pitch is possible.

Availability of longer lengths (up to 16-ft.) of graphite tubes together with a closer tube pitch has resulted in relatively inexpensive exchangers. Plastic units now compete successfully with the least expensive stainless steel heat exchangers and for some time have been even less costly than many metal constructions including copper, Monel, nickel.

Plastics as Construction Materials

Majority of plastic units are of the outside packed floating tube sheet construction.* Several other constructions are still available, however. These are: double-packed floating head, diaphragm type, packed floating head, inside floating head. These four types, however, have in general been replaced by the outside-packed floating tube sheet type.

The change has taken place because of simplicity of design, cost and low maintenance.

The workhorse plastics — phenolics and furans, carbon or asbestos filled—cover the majority of exchanger applications, particularly for tube sheets and shells.

* Steel: shell, packing grand follower, split ring and backing ring, bolts and nuts.

Phenolics and furans have a safe range of use to 300 F.

The advantage of glass reinforced polyester comes in applications where higher pressures are encountered. Pressure resistance again is an advantage of the PVC lined steel; however, with this combination of materials, there is a serious temperature limitation. Though the steel adds strength, PVC is only recommended for safe operation to 150 F.

Polyester glass, a tough, strong chemical-resistant material is satisfactory for continuous use to 212 F., and for intermittent service to temperatures as high as 265 F.

Tubeside Materials

For tubes, impervious graphite is recommended to 338 F.

Tube sheets are made from acid digested asbestos or carbon-filled furan or phenolic, impervious graphite, epoxies, drilled to receive the tubes.

Tubeside design pressure of the standard graphite tubed heat exchangers is 75 psig. This pressure may be decreased somewhat by certain special channel arrangements. Steel shells can also be designed for 75 psig. The design pressure of larger plastic shells, however, will generally be somewhat less than this (30-in. shell can be designed for 50 psig.) and will be limited by the physical properties of the plastic and the operating temperature of the shellside fluid.

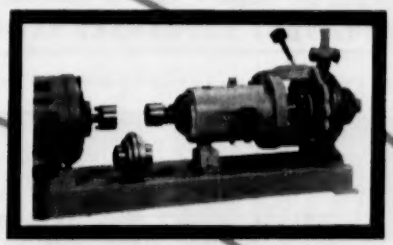
Some Design Limitations

Aside from corrosion, it might appear that tubes are a limiting factor in the design, with an approved working pressure for impervious graphite tubes of 75 psig. and the glass tubes safely carrying less. Actually this is not the case. Design limit is first reached in the shell or the tube sheet with impervious graphite tube exchangers and usually in the rubber ferrules with glass tube exchangers.

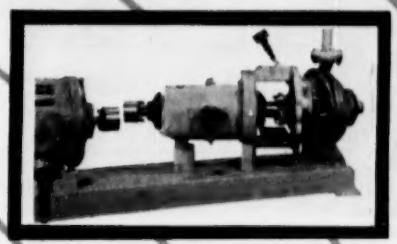
Hoop strength of the shell is the limiting factor in larger diameter exchangers, especially when the inlet and outlet nozzles enter through the side walls.

On the tube side, the controlling factor in most cases would be the problem of devel-

Time is money - and so is labor!



1. Remove spacer from coupling.



2. Remove cap screws.



3. Remove the pump. Note: Neither suction or discharge lines are disturbed, nor is motor or alignment affected.

3 simple steps remove SERIES H DURCOPUMPS for maintenance

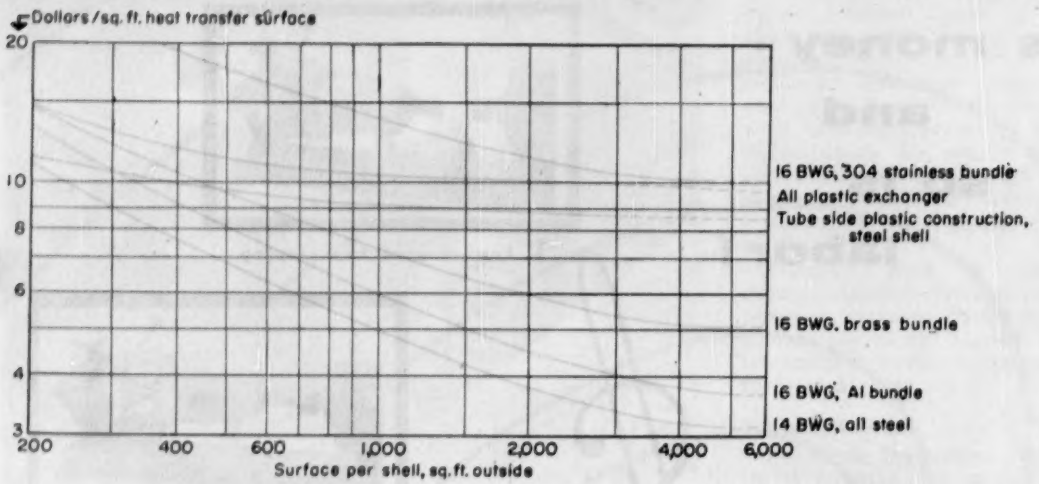
Lower operating and maintenance costs with rugged, dependable, Series H Durcopumps. Simple design and sturdy construction assure long hours of trouble-free pumping. Easy, three-step, one-trade maintenance reduces down time, speeds maintenance, and lowers costs. Series H Durcopumps are available in Durimet 20, the 300 series stainless steels and in eleven other standard alloys for pumping all types of corrosive solutions. A complete range of pump sizes accommodates heads to 350 ft. and capacities to 4500 gpm. Write for details.

DURCO

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Approximate Costs of Floating Head Exchangers



oping hoop strength in the cylindrical walls of the channel cover, especially where side entering nozzles are used. In general, as shell diameter increases hoop strength of channels and shell will control the design unless extensive reinforcing is provided.

Considerable thought and effort has gone into the study of pre-stressing or reinforcing for hoop strength. Even with prestressed reinforcing of cylindrical shells and heads, the gap in the shell (or head) where the nozzles enter is a weak spot where hoop strength can be developed only with difficulty. This can often prove the limiting factor in design.

Impervious graphite tubes are tested at several hundred pounds pressure so there is ample margin of safety. Actually, 75 psig. is not as much a limiting factor as temperature. Pressures in chemical processing are seldom maintained without corresponding heat. For example, at 340 F. (our maximum allowable temperature for impervious graphite) steam pressure is 104 psig.

Heat Transfer Characteristics

The heat transfer characteristics of corrosion resistant plastic heat exchangers is similar to metal exchangers, but some misconceptions should be cleared up.

In the basic heat transfer equation $Q = UA\Delta t$, all factors are calculated as for metal exchangers. The log mean temperature difference (LMTD), is calculated from terminal temperature conditions. Corrections for multi-pass arrangements are made in the same manner as in metal exchangers. Q is usually calculated from lb./hr. of gas or liquid, specific heat and temperature change through the exchanger.

The difference between plastic and metal shows up in the overall heat transfer rate U, which depends somewhat on tube materials of construction. However, U is not alone a function of the tube. It also depends on fluid or gas films and corrosion and fouling films on each side of the tube.

A look at thermal conductivity of materials alone can be very informative but deceptive:

	Conductivity*
Silver	2,900
Copper	2,680
Aluminum	1,570
Red brass (85-15)	1,100
Impervious graphite	972
Yellow brass (65-35)	830
Zinc	770
Admiralty brass	760
Mild steel (1020)	460
Nickel silver (18%)	230
Monel	180
Stainless (304,316,321)	105
Inconel	104
Glass	7.26
Asbestos filled phenolic resin	2.45

* Btu./hr. sq. ft. F./in.

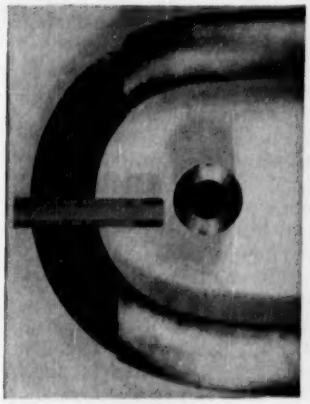
On the basis of uniform thickness of one in., impervious graphite has a larger heat transfer rate than mild steel. In actual practice the transfer is about the same as the wall thickness of impervious graphite tubes is approximately $\frac{1}{8}$-in. as opposed to the standard 16 gage steel heat exchanger tubes. The graphite tube however, has a substantially greater heat transfer than stainless 304, Inconel, etc. even when considering different thickness.

Glass has a decidedly poorer heat transfer rate than mild steel. However, for the applications where glass is used—mainly gas to liquid transfer—

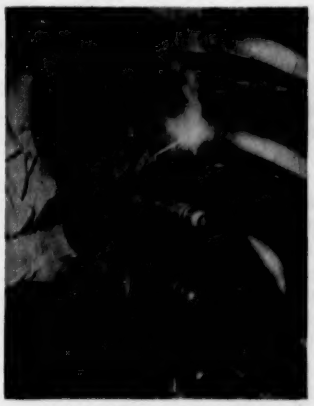
BRIDGEPORT BRASS

COPPER ALLOY BULLETIN

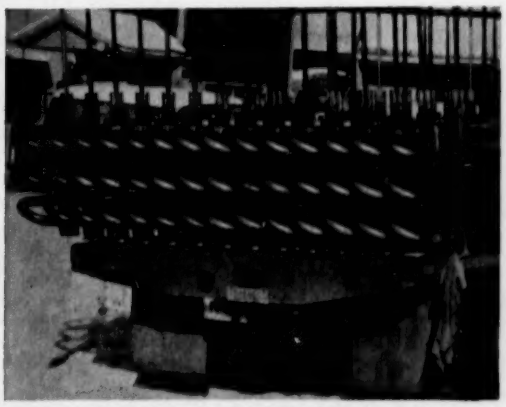
CONDENSER AND HEAT EXCHANGER TUBE EDITION



Cutaway and end view of heavy wall duplex.



Welding bent tube ends on to straight tube lengths.



Assembled tube coils showing tube ends in place.

5,016 Feet of Heavy Wall Bridgeport Duplex Tube Provide Economical Answer to Unusual Pressure and Corrosion Problem

Unique Fabrication Methods Used to Bend 22-ft. Lengths to Small Radius

In designing a new anhydrous ammonia plant for Northern Chemical Industries of Maine, the Girdler Company, Louisville, Ky., faced a number of important considerations in selecting the coils for the plant's primary and secondary condensers.

First, the condenser tubes had to be heavy enough to pass a hydrostatic test of 7500 psi. Second, unique fabricating requirements had to be met; tube ends had to be shaped into J-bends well under the usual minimum bend radius. Third, the "standard" problems of ammonia and sea-water corrosion had to be solved. Throughout, cost was a constant consideration.

Condenser Make-Up

The condensers themselves consist of one section with fourteen parallel banks of six passes each, and a section of fourteen parallel banks of ten passes each. Each section has an inlet and outlet header.

Bridgeport Duplex Chosen

Bridgeport Duplex Tube was selected, heavy steel inside to withstand pressure and resist ammonia corrosion, and .065" inhibited Admiralty cladding on the outside to combat sea-water corrosion. Stainless steel was considered, but because of its debatable service life *and* cost, was not chosen. The cost of Cupro-Nickel and Nickel-Copper Alloy was also too high. Admiralty-clad Duplex Tubes, on the other hand, have an estimated life of eight years—plus.

Precise Fabrication Problems

The near-mile of tube that went into both condenser coils was supplied in 22-foot lengths and was formed into finished coils by Portland Copper and Tank Works, Inc., So. Portland, Maine. One end of each tube had to be bent to a 4-7/16" radius, a job so precise that a special bending die was designed and built for the job.

Joining the bent tube lengths into finished coils involved stripping back the Admiralty cladding two inches from the end of each tube length. The exposed steel tube ends then were welded together and the weld surface ground smooth with the OD of the tube. Six-inch Admiralty sleeves were slipped into place and brazed in position. Special fabricating techniques were observed throughout every step of the operation.

Bridgeport for Precise Requirements

Bridgeport Duplex Tubes, of many varieties, have a long history of service and efficiency. As in this case, they are often the economical *answer* to a number of problems. Their wide use in ammonia refrigeration systems, ammonia and synthetic rubber production, the process industries, chemical plants, the petroleum industry and coke by-products plants is an "in-service" endorsement which can be applied to your own needs.

Bridgeport's experience with virtually every kind of corrosion and fabricating problem can serve you well. Put it to work for you. Call your nearest Bridgeport Office today.

BRIDGEPORT BRASS

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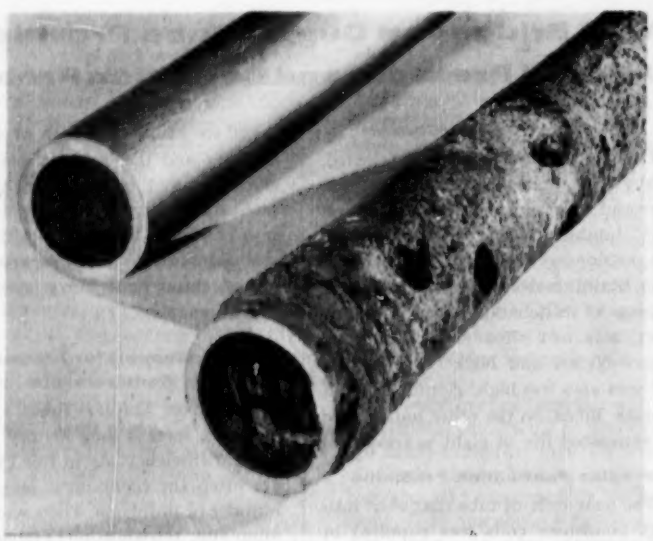
film resistances become more important than thermal conductivity.

Let's follow through a typical design condition and see the effects of film resistances and thermal conductivity, in liquid-liquid, gas-liquid exchange situations for steel, stainless, brass, impervious graphite and glass materials.

For liquid-liquid assume h_i and h_o are 200 and the fouling factors are 0.001. Calculating U shows that an area increase of 52% would be necessary to replace mild steel tubes with glass, but impervious graphite mild steel, stainless, have virtually equal coefficients. We've assumed here that the metals have a wall thickness of 0.0625, graphite has a wall thickness of 0.1875 and glass 0.047. These are usual working thicknesses for exchangers.

For gas to liquid exchange the gas film coefficient will be around 20 for turbulent flow. In this case glass tubes require 11% more area than mild steel. Impervious graphite, steel and brass have about the same U.

In handling large volumes of gas, where power becomes an important factor, it is essential that the gas pressure drop be as low as possible. We come usually, under these conditions, to viscous flow on the gas side. Here h_i could be 8, and the glass unit requires about 5% more area than steel, stainless or brass, while impervious graphite calls for about the same area as steel.



New Nickel Cladding Provides Low Cost Protection

Now you can put a nickel-alloy coating on ferrous metals. The recently developed "Niphos Process," available through Tube Reducing Corp., involves applying a mixture of nickel oxide and ammonium phosphate to low-cost base metal. This, heated in a reducing atmosphere, results in a tightly adhering nickel-alloy cladding, which doesn't flake in a 180-degree bend.

Average coating, applied primarily for corrosion protection, is about 0.001-in. thick. But coatings of 0.025-in. have been obtained, and thicknesses can be built up by repeated applications. Cladding prevents base metal scaling at temperatures up to 1,150 F.

Fouling Factors Are Important

The highly important fouling factors also point up differences in design between metal and plastic exchangers. These factors allow for the build up of sludge, algae and corrosion products. Actually our analysis above considered identical fouling factors for metal and plastic. This is not strictly true, since they depend on the materials of construction.

With plastic and graphite construction, corrosion is not a problem, provided the proper material has been selected. And it is possible to thoroughly clean a plastic exchanger—not always possible with metals due to corrosion. If correct fouling factors are applied, over-all U can, in some cases, be higher for plastics, as compared to mild steel.

Also remember in corrosive service the fluid being heated or cooled is a good cleaning agent. This should be taken into account in assigning fouling factors.

Available Sizes and Types

Types of exchangers discussed are produced by a number of manufacturers and are available as standard units. Special units of course are available. Standard or off-the-shelf exchangers are available up to approximately 3,000 sq. ft. outside heat transfer surface.

An example of a glass tube exchanger is one designed to cool aqua regia vapors from 150 to 100 F. It contains over 1,200 glass tubes, 10 ft. long. It's designed to handle 5,000 cfm. at a maximum pressure drop of ½-in. water and is standing up very well under this service.

Upper tube sheet consists of 2-in. thick PVC drilled to accept ¾-in. tubes. The 1-in. thick PVC baffles are mounted on PVC saddles welded to the PVC lining. Drilled baffles are strong enough to sustain the weight of a man crawling through the unit prior to assembly of the tubes. Hypalon ferrules are forced around the end of the tubes and wedged into the tube sheet. A positive seal, good for pressure differentials up to 5 to 6-in. of water, is obtained.

Actually a wide variety of

US RUBBER PERMOBOND COVERINGS



The Case of the Frustrated Sea Monster

Put steel propeller shafts in contact with bronze bearings. Then add salt water and you create a *monster.*

The three have combined to produce an electrolytic action which pits the steel shaft, weakening it and inviting breakage under the severe stresses involved in the radical maneuvering of fighting ships.

In such great new super-carriers as the "Forrestal" and "Saratoga" (as in their predecessor of decades ago, the first "Lexington") this "monster" of electrolysis can't exist. Propeller shafts are covered with U. S. Permobond®, the rubber lining that defies electrolytic attack and corrosion.

Permobond Covering and Linings can be applied to any metal section, large or small, simple or complex. When unit is too large to ship, our field crew will install and vulcanize Permobond right in your own plant, or install Permobond as original equipment in the fabricator's plant. Where special conditions occur, a wide range of synthetic Permobond lining stocks is available.

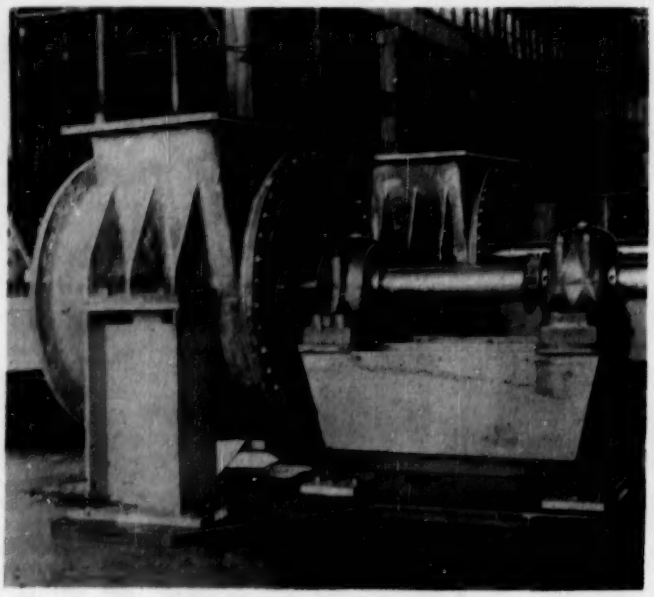
If there's a monster on sea or land, corroding your operations, get in touch with any of the 28 "U. S." District Sales Offices or write us at Rockefeller Center, New York 20, N. Y.

In Canada, Dominion Rubber Co., Ltd.

US RUBBER Mechanical Goods Division

United States Rubber

SEE THINGS YOU NEVER SAW BEFORE. VISIT U. S. RUBBER'S NEW EXHIBIT HALL, ROCKEFELLER CENTER, N. Y.



Cast Stainless Defeats Intergranular Corrosion

Cast stainless equipment is fast becoming a familiar item in chemical plants. A case in point is at Westvaco's South Charleston plant, where material for a 20,000 gpm. screw pump is a Mo-containing cast stainless (CF-7M, with 19% Cr, 9% Ni, 2.5% Mo and 0.07% max. C) equivalent to Type 316 stainless in corrosion resistance.

Circulating a solution of calcium and magnesium chlorides with 8-10% NaCl, copper, bronze and a cast stainless equivalent to Type 304 stainless all proved unsatisfactory before CF-7M. (Alloy Casting Institute).

The trick was in solution heat treating the cast material at 2,050-2,100 F. for one hr., then applying a water quench. This puts carbon into solution, so no precipitated chromium carbide areas act as focal points for intergranular corrosion.

sizes and shapes are produced with glass or impervious graphite tubes, with steel or plastic shells. Some chlorine coolers run as high as 12-ft in dia., providing some 15,000 sq. ft. of transfer surface.

Cost curves for simple standard units are shown. Special designs are more expensive, but the proportional increase with plastics is usually less because of the ease in producing single pieces of equipment without special dies, molds or fixtures. An impervious graphite tubed exchanger with phenolic shell is represented. A glass tube exchanger with phenolic shell and baffles would be about the same. The same exchanger with a mild steel shell would cost approximately 25% less. Upper curve is for 304 stainless.

New Low-Cost Stainless by Diffusion

A new "stainless" steel in sheet form, costing 50% less than solid stainless, has been announced by the Chromalloy Corp.

Claimed to stand up to temperatures of 1,500 F., the sheet reportedly has the corrosion resistance of type 400 series stainless.

Actually the new sheet is the product of a chromium diffusion process. Treatment involves enclosing a low-carbon steel in a hermetically sealed retort with a solid chromium compound. This is held at 1,500-2,100 F. for two hr. or more.

At the high temperature a chromium-bearing gas is produced. As this gas comes in contact with the ferrous surface, a reaction takes place. The gas deposits chromium and picks up an equivalent amount of iron. This reaction is reversed at the interface of the gas and the chromium compound. Reaction proceeds until the chromium completely covers all exposed surfaces of the steel. Chromium diffuses into the steel both in the grain boundaries and in alloy with the iron. Of course, the chromium content tapers off gradually through the core from about 40% Cr to about 13%; then it drops sharply.

The treatment temperature can vary, depending on the base metal composition, section thicknesses, and desired characteristics of the finished material. However, the temperatures are high enough, and the cooling sufficiently slow, to anneal the material.

Stainless steel material is formed from low-carbon steels. On high-carbon material, chromium carbide forms, producing a product with a Vickers hardness of 1,800-2,200.

The treated material is ductile, since the chromium content blends into the steel core without a sharp transition. It is possible to work and form the finished material.

Treated stainless steel sheet is priced now at about 49¢/lb. This compares with warehouse prices of 76¢ to $1.50/lb. for solid stainless steels.

Prior to the development of the new sheet form, chromium diffusion was confined largely to custom treatment of metal parts such as valves, gears, heat exchanger components.

A number of companies are in this field, besides Chromalloy, including the Alloy Surfaces Co.



CORROSION'S FOCAL POINTS are easy to detect with a new Amercoat testing method using iron and caustic indicators in a saline gelatin bath. On the welded and scored steel panels shown above after test, unworked surface areas turned red to indicate cathodic properties; but the weld, scores and edges turned blue (here shown blackened) to reveal themselves as anodic corrosion breeders. Rivets, threads, crevices and abrasions also show anodic under test. Unless such areas are effectively sealed from moisture, oxygen and ions they will erupt as focal points of corrosion cells.

How to protect "trouble spots" against corrosion

Ask a corrosion engineer where metal corrosion is likely to attack first. Chances are that he will name rivets, threads, sharp edges, angles, crevices and welds. These are the areas of stress concentration, work hardness, fissures and abrasions. They tend to be anodic and actually breed corrosion. And although they warrant increased protection, conventional coatings pull away from their sharp profiles and leave them inadequately covered.

Amercoat No. 87, a true vinyl mastic, protects these spots in a single coat 10 mils thick, whereas other coatings fail to build 5 mils in three coats. It cuts maintenance painting costs up to 50% because you don't have to re-erect staging and scaffolds for additional coats, and you get results that last.

No. 87 combines the time-tested chemical and weather resistance of vinyl coatings with the thickness of mastic, yet it is easily sprayed with standard equipment over a suitable primer. Available in white, gray, black and aluminum. Use it for enduring protection at lower cost per square foot per year. Complete details mailed on request.—Amercoat Corp., South Gate, Calif.

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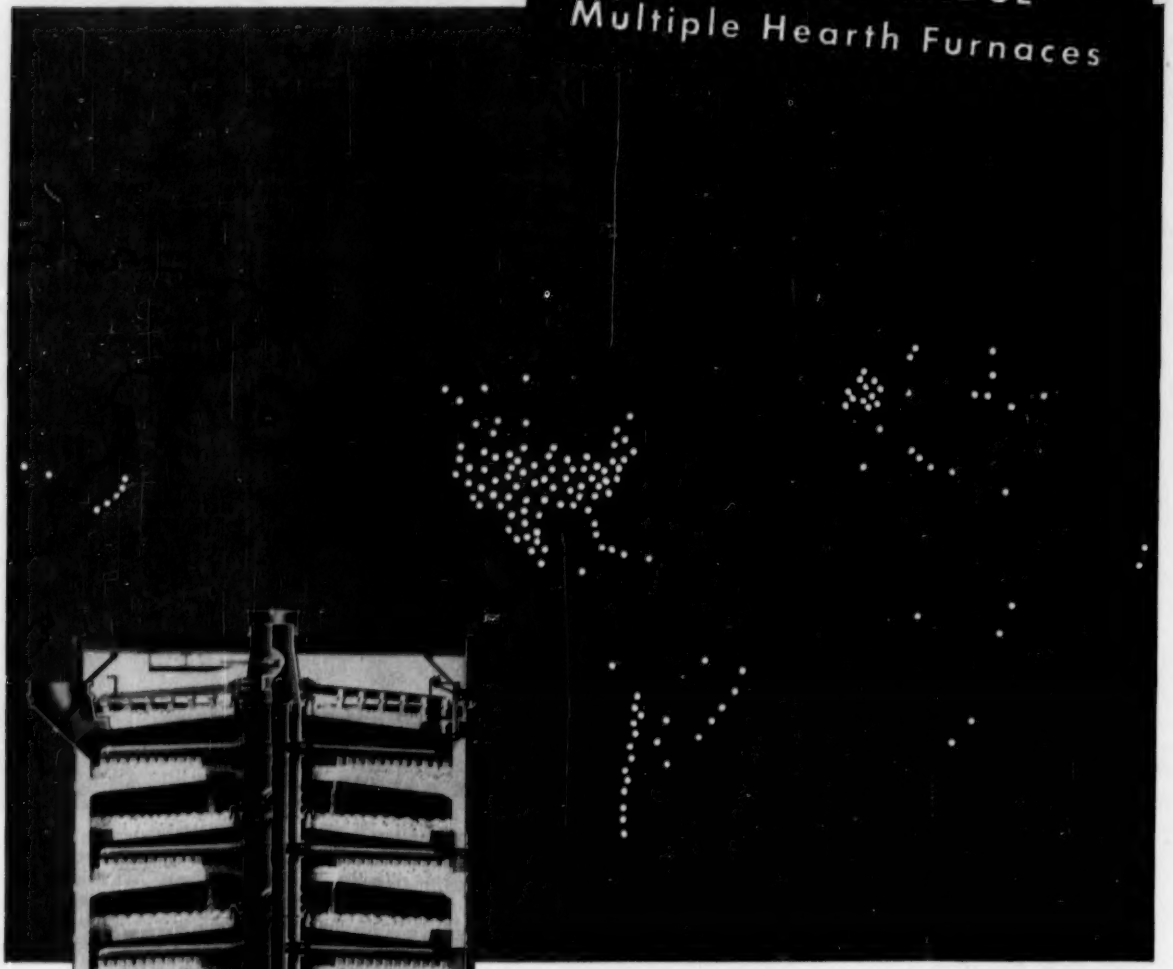
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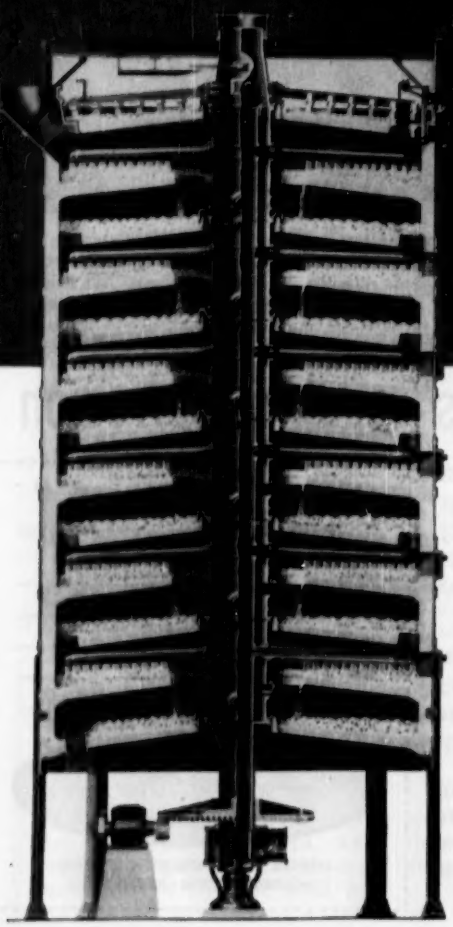


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Chemical Engineering

People

SEPTEMBER 1957

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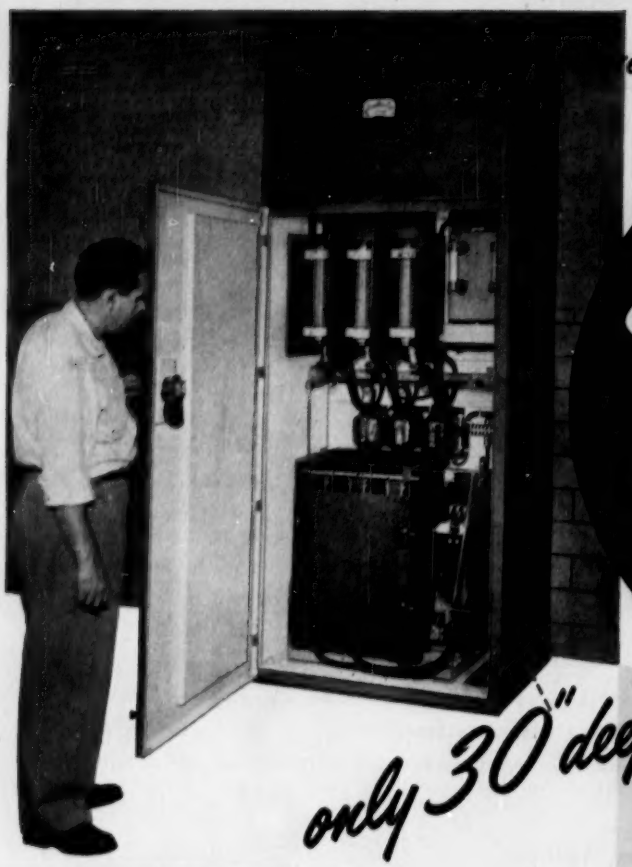
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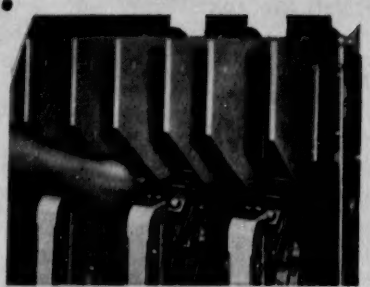
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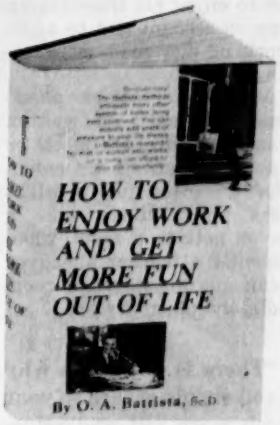
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With an expense account . . . How do you stay out of the red and in the good graces of the company?

Can you come back from a trip without feeling worn out?



When and how much should you entertain business associates?

How do you keep your wife and kids happy while you're on the road?

Plane or train?

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How to Enjoy Work While on the Road

O. A. Battista, Drexel Hill, Pa.*

"How do you handle the problem of traveling on an expense account so that you never end up in the red?"

I put this question to one of today's top advertising executives.

"Nothing to it," he replied, "I follow a simple five-step procedure that is foolproof. No tax agent, company accountant or employer will question any expenses that are incurred when this formula is used. It complies with all the rules of the game of being put on the honor system with what amounts to a blank check." Here are the rules he gave me:

• Draw out more money than you expect to use on the trip. Always make it a round figure like $150, $200 or $500, depending on the nature of the trip.

• Before you start the trip, empty your wallet and your pocket of all your personal money. Fill them with as much "company" money as you estimate you'll need with a safety surplus of at least 25%. Travel credit cards are, of course, very helpful if you can get them.

• Disobeying this next rule is what lands most travelers in the red. Spend money while traveling on an expense account as though it were your very own. Don't skimp or splurge. Just insist on getting what you need and what you pay for as an official company representative.

• Fill out the expense account report honestly, exactly as your money was spent and return the balance due with your expense report.

• Refill your wallet and your pockets with the money you dumped into your desk drawer or bureau before you started the trip. Financially, you should be in exactly the same boat that you were in before making the trip.

The Case for Honesty

My experience has been that honest expense reporting pays off. There was a time when it was necessary for me to carry a brisk travel load with the man who was my direct superior. This elderly gentleman was authorized to sign his own expense accounts and, of course, he had to sign mine.

My breakfast on a trip was usually on the heavy side—cereal, bacon and eggs, toast, marmalade, coffee. But the boss never had anything but toast and coffee—20¢, plus a 10¢ tip. On several occasions I happened to see his expense reports and the 30¢ breakfast charges were always lined up like lights along a railroad track.

---

* Meet your author on p. 345. Condensed from a chapter in the book "How to Enjoy Work and Get More Fun Out of Life." Copyright 1957 by Dr. Orlando A. Battista. Published at $4.95 by Prentice-Hall, Inc., Englewood Cliffs, N. J. Reproduced with permission.

"Don't skimp or splurge. Just insist on getting what you need and what you pay for as an official company representative."

This man, I am sure, never made an extra penny by traveling.

He told me—as I have since found out—that nothing shows up the true character of a man like studying his expense reports. The "padders" stand out like bold type across a printed page.

One day my boss received an expense report from one of his men that had a $14 taxi fare listed on it. A single look at the name of the man making the report was all he needed before he approved it. Time and again he knew that this man's expense reports had been "dead-honest." His reaction to the $14 taxi fare was, "If Jim says he paid that much, he not only paid it, but there was a good reason for it." This was exactly the story he gave the accountant in the company controller's office when he called him up about it; that closed the case.

"My experience has been that honest expense reporting pays off."

The facts behind the expensive taxi ride justified my boss' faith. Jim received word while away on a trip that his wife was giving birth to their first child a week ahead of the expected date. Under the circumstances, a 55-mile taxi ride to catch the only remaining flight out of a midwestern city was the only logical answer.

Ten Tested Travel Tips

There is no reason why you should return to your job after an expense account trip worn out and reluctant to tackle the pile of work that accumulated on your desk or mailbasket during your absence.

Here's how one engineer I know regulates most of his traveling time. He uses business travel as a means of getting certain kinds of work done as well as to stimulate his thinking along new lines.

My friend Wilbur is a product development engineer. He averages about one business trip a week. Usually one associate tags along with him. Here are the most important habits that help Wilbur to enjoy his traveling on an expense account and to make his work on the road more rewarding:

• Make reservations ahead of time and insist on written confirmation. Adequate motel or hotel accommodations are essential for a successful overnight business trip. Never take a chance on getting a room, when a moment's attention ahead of time can guarantee you a room immediately upon arrival.

"There is no reason why you should return to your job worn out and reluctant to tackle the pile of work on your desk."

When attending a convention that is scheduled months ahead of time, Wilbur always has his written reservation tucked in his wallet several weeks ahead of time. As a matter of fact, Wilbur tells me it is common practice for him to book reservations six months to a year ahead when he knows it will be necessary for him to attend a scheduled meeting. Hotel men get to know customers who make early reservations, and like them. You'll get better treatment than the fellow who pounds the desk at the last minute looking even for a cot to rest his weary bones.

• When you travel with an associate, make separate room reservations, at least now and then. Wilbur does this for several reasons, none of which has anything to do with being a recluse. He argues that he sees enough of his buddies during regular working hours. Separate rooms—even adjacent to each other—offer each traveler a chance to "get away from it all and from everybody" for a few precious hours.

• Always call your wife the first evening you're away from home. Most companies agree that this is a *bona fide* business expense. It does you a lot of good, and works wonders with Mom and the children, who may have just finished a routine meal without you.

• Always travel light. Time was, before the days of Dacron, Orlon, Acrilan and nylon, when a man was obliged to load himself down with two heavy suitcases for a four-day trip. Now, a medium-sized traveling bag can easily accommodate all your travel needs for a full week, or even longer.

By traveling as light as possible, you will be going easier on your heart, be less likely to forget to take needed things or leave them behind. Leaving out or leaving behind even a small item like a nail file can take pleasure out of an expense-account trip. Wilbur has prepared travel checklists to suit his own needs for a two-day, a four-day or a one-week trip, respectively. Just before he leaves on a trip he goes over the appropriate checklist.

• Never overeat or overindulge in drink while on an expense account. Wilbur admits that he "eats like a king" on an expense account, but more sensibly. Of course he likes filet mignon and sirloin steaks. But he's careful to concentrate on these healthful, energizing dishes and to shy away from pastries and high-calorie desserts.

"Overindulgence in alcohol has cost many a man his reputation, sometimes his job."

He uses expense-paid trips to eat natural vitamins in the best of foods, "the kind I enjoy eating and can afford only on special occasions at home." By eating well, he argues that he is servicing his body so that it will be in better condition to perform in the interests of his employer.

Never skimp on quality when you're away on an expense account. Never gorge yourself with quantity, either, or you'll ruin your whole trip and run the risk of losing the business you are out to get.

Overindulgence in alcohol on an expense account has cost many a man his reputation, sometimes



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his job. Host your business friends and—if you so choose—drink in moderation along with them. But under no circumstances hoodwink yourself or let yourself be hoodwinked into drinking to the intoxication point.

A salesman I knew once carried on foolishly at a restaurant when he became highly intoxicated. Among other things, he slammed a table with his glass so hard that he cut his hand with it.

His boss purposely avoided traveling with him again, and it took only six months to ease him out of the sales force because his alcoholic escapades were a serious liability to the company.

This was a difficult decision for the boss to make, because the young man had many virtues that weighed heavily in his favor. But alcoholic noisemakers on a business trip can easily put the skids under promising business deals.

It is, of course, common practice for a company to evaluate a man on two points before appointing him to a responsible position that will expose him to heavy rounds of business entertainment. First, they'll rate his "capacity" for alcohol. Then, they'll rate his ability to stop before he exceeds this maximum capacity.

• Carry lots of small change. Wilbur always sees to it that he has an ample supply of quarters and dimes on hand when he's traveling. Tipping is a must and it is a travel habit he has developed to ask for change in dimes and quarters each time he pays for a meal. This guarantees him an adequate supply.

• Recognize your entertainment responsibilities. "The only time I go out of my way to pick up the other fellow's tab," Wilbur told me, "is when I have invited him to be my guest, or when he may be a government employee."

Whom and how many persons you entertain on a business trip must be determined by good judgment under specific circumstances. Some travelers I have been with overdo it. They act like a jolly Santa Claus on the spot, and then find it quite a job to explain it all on their expense

"Whom and how many persons you entertain must be determined by good judgment under specific circumstances."

reports. Such philanthropy can detract from the pleasure of a trip.

Once again, how much company money you spend on entertainment can weigh heavily for or against you in the eyes of the higher echelons who must approve your expense report.

Wilbur's comment about footing the bill for government employees merits some clarification: Employees of the Federal Government usually are faced with severe budget problems when they are traveling on business. They are allowed a flat sum which is frequently inadequate in a large city. In order to break even, they must stay at small, out-of-the-way hotels where they can get a room for $4.50 instead of $9. They eat their meals—as a rule—in hotel coffee shops or smaller restaurants. Wilbur's policy of treating Civil Service employees on appropriate occasions is a practice that can add much to business trips.

• Take baths instead of showers. "The only time I take baths," says Wilbur, "is on a business trip. At other times, I take showers."

The disappearance of the good old-fashioned bathtub from modern homes in favor of the speedy stall shower is a sad trend that reflects the influence of the speed craze in modern living routines. A limited survey that I have made indicates that many men and women today seldom—if ever—take a good old-fashioned bath because a 60-second shower suits their routine so much better.

"This," according to friend Wilbur, "is what I do at home, too. But on a business trip I arrange my schedule so I will have time at the end of each day to take a slow, invigorating bath. It is the most practical thing next to owning a backyard swimming pool, and, thank goodness, bathtubs are bound to be standard equipment in hotels, at least, for a long time to come."

• Relax with a book. Read one book a trip. "I relax best on a trip," says Wilbur, "with a good book." It usually is a mistake on a business trip to try and disrupt your usual sleep routine; going to bed much earlier than usual may only result in rolling and tossing. But read a good book while you're comfortably propped up in bed with adequate lighting, and you'll roll over like a log when your body's need for sleep makes itself felt.

A book—even a "whodunit"—is far better than a newspaper or a study of the day's stock-market trends.

• Catch up on shut-eye. As a rule, fathers of young children find a trip away from home a good time to try and catch up on a little lost sleep. When your children are still young, use a business trip as a means of getting some extra rest by going to bed not later than 9 P.M.

Once or twice a year this can represent a refreshing change of pace from the nightly chore of helping with the dishes, the homework, the bathing, the bedtime story-reading, etc.

Train Vs. Plane

Before you decide whether you will go by train or plane, study your travel schedules carefully and determine which mode of transportation (or which combination of train and plane) will permit you to get the most out of the trip.

"The more work you can get done en route, the easier going it will be for you when you return."

As a general rule, take a train whenever appointments allow the time, because you can get more work done on a train. The more work you can get done *en route*, the easier going it will be for you when you return to home base. As one sales engineer put it to me, "It is a wonderful thing to return after a trip knowing that you have everything just about ready to turn over to a secretary for typing."

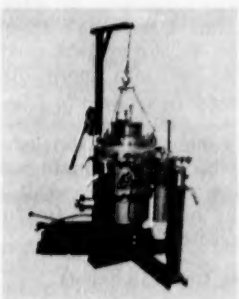
Get More Fun Out of It

The travel tips that Wilbur gave us above are the bare minimums for insuring a pleasant trip while you're away on your



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expense account. We are indebted to Donald J., a sales engineer, for a few fruits from his experience on the road that may suggest ways for you to get more enjoyment out of your work while traveling.

Don found from experience that certain kinds of work could be done on the road, whereas other kinds were best handled at home. He set up a special folder in a desk drawer into which went any chore that could be handled on his next trip and could wait that long. For example, into this folder went such things as: special magazine articles for leisurely study; correspondence to answer—by making marginal notes from which the secretary can compose the reply; financial and biographical information about the firms and executives that he expects to meet, including the most recent annual report of their activities.

Don always carried a small but durable memo book in which he prepared what he called contact questionnaires.

On each trip he would make headings of each contact his schedule would include. He then proceeded to build up a questionnaire covering his dealings with each individual or firm. He never tried to make such questionnaires complete before starting his trip. His experience was that your mind demonstrates remarkable versatility at times on the road, and if you give it full freedom to skip from one problem to the next, it comes up with many novel slants. As these come to mind, into the little memo book, under the appropriate heading they go. In this way, the questionnaire on each contact grows with the trip and becomes far more effective than if it had been forced together back at the desk in the office.

When Don reaches each destination, as a result of his random thinking *en route*, he has a well-organized plan in order. "Nothing adds to your pleasure on a business trip like knowing ahead of time exactly what you want to take up with your contact, and what you hope to achieve by your trip."

Guard Company Information

When two or more persons are together on a company trip, it is almost inevitable for them to talk shop.

"I have been amazed," Don says, "to observe how often traveling people will discuss confidential company business openly on a train or plane, assuming that those within earshot would have no interest in the information. On one trip, for example, I listened to a group of executives discuss salary changes for managers of branch locations as well as the sales-and-profits figures for each of the locations involved. Confidential information is best withheld for more private discussion because inadvertent release of it to a competitive, attentive ear could eventually bring unhappy repercussions."

Why Not Study?

A plane or train can provide excellent opportunities to advance your education along some particular line in which you feel weak. For example, Don always has been weak on the subject of modern accounting practices—his formal training was as a chemical engineer. As a result, on his travels he has been bringing along books that he borrows from the company's controller. He believes that a sales manager or a salesman should know what goes on behind the scenes to produce many of the figures they must study or use. Don now knows the accounting end of his firm's business very well, thanks to the studying he did on his trips.

Work in Short Spurts

Don's experience is that it is best and most efficient to hop, skip and jump to different projects while on the road because circumstances usually are such as to preclude stretches of concentration.

Although frequent interruptions may break into sustained thought, the traveler's mind often displays marvelous vitality and surprising powers of memory.

Don claims that some of his best brainstorms have clicked into being while he was letting his mind grapple for good company ideas at 20,000 ft. or with the clickety-click of the rails under him.

He likes to set aside about a half hour on each trip for an idea clinic of his own. He thinks about such questions as these: Who else should be buying our company's products? What products should we be making and selling five years from now? What competitive products threaten the most? What ideas for study can I suggest to the company's research director the next time I see him? How can we modify our present products to lead us into more diverse markets?

Don is well known in his company's management circles as a man who keeps "thinking ahead for the company" and it isn't hurting his prospects for future advancement in the least.

Outline Your Call Report

A person travels on an expense account with a definite end-purpose in mind. Don's policy is always to outline the major points of what he'll write or dictate later as his "report of call." He always does this before he heads for home, or on the way.

"It is immediately after conferences or meetings," says Don, "that my mind is best able to sift out the most information or

Next Month: Hitch Your Wagon to a Star

Modern American culture has its fair share of fads, bandwagons and sincere enthusiasms. In popular music, for example, this seems to be the year of country music, calypso, rock 'n' roll and cha-cha-cha. In the same way, wherever engineers gather this year their conversations drift toward what the young engineer can do to develop himself professionally. Next month—with help from our San Francisco and Dallas news bureaus—we'll report on one of today's hottest topics. Professional development, front and center!

Case No. 58

Results Bring Re-Order from Heyden Chemical Corp. for Second Kemp Inert Gas Generator

Heyden Chemical doubles its blanketing savings with Second Kemp Generator

HERE'S A CASE where simple mathematics paid big dividends at this Garfield, New Jersey plant. When Heyden Chemical—one of the nation's leading producers of formaldehyde, pentaerythritol, salicylic acid, etc.—installed its first Kemp Inert Gas Generator to furnish CO_2 for blanketing a special grinding operation, it was on more or less a test basis. Part of Heyden's constant search for newer, better, cheaper ways to improve its products. The rest of its blanketing needs were still being handled with CO_2 from large storage tanks in the plant.

Immediate Savings with Kemp

Results with the first Kemp Inert Producer were impressive. Now a second (see right) Kemp unit has been installed and actual savings over previous costs are estimated at over $500 a month for the first year. In addition to dollars saved, Kemp Generators assure a safe, dependable supply of chemically clean inerts. Deliver inerts at a special analysis . . . without fluctuations.

Kemp Designs Versatile

If you still rely on old-fashioned inert sources or are dissatisfied with present inert equipment, let Kemp help you, too. Kemp Engineers will be most happy to help solve your inert problems . . . show you how you can get similar results with fast-starting, easy-to-operate Kemp Generators. It costs you nothing to investigate. And it may save you real money.

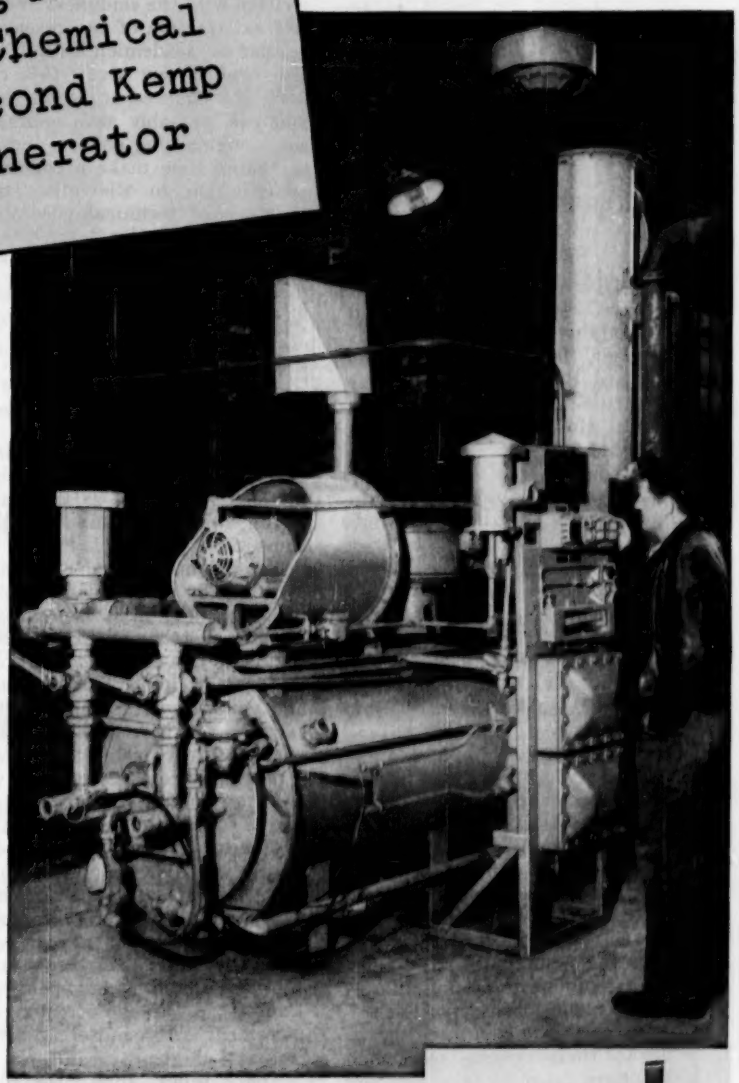
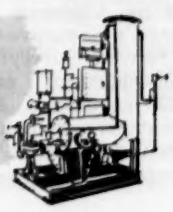




Photo at right shows close-up view of Kemp Industrial Carburetor. Part of every Kemp installation, it eliminates tinkering, waste. Assures complete combustion at all times. Reduces installation costs and maintenance.

For more complete facts and technical information, write for Bulletin I-10 to:
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conclusions. If I do this job before I head for home, I can relax on the return trip in the knowledge that I'm well prepared to deliver the proverbial 'pound of flesh' in terms of a report with a minimum of effort."

RECOMMENDED

. . . *for Careful Study*

You'll want to look at—and perhaps, spend some careful moments with—a report to management, just released by the Harvard Business School under the title "Engineering Manpower: How to Improve Its Productivity."

Although the $18.50/copy price tag is somewhat frightening, this 162-p. booklet has hidden treasures buried in its simple covers, its unillustrated close-packed text pages and its hard-to-read single-spaced typing.

Very little is known today about industry's use of engineering and scientific manpower. Little of a comprehensive nature has been written on how engineering productivity can be improved. Essentially, this is the subject of this project report.

In the words of the authors, "We have written as businessmen for businessmen. Described in the following pages you will find the results of our study. We have very simply described what we have found to be the philosophy, policies and practices of American industrial concerns toward their technical personnel. We have tried to take into account viewpoints of both management and engineers.

"We hope that those who read what we have written here will pause to reflect on this problem. For generally speaking, engineering and technical talent *is* being wasted to considerable degree. This fact, in our opinion, influences the attractiveness of the engineering profession adversely. Thus, it may be a contributing factor to the current shortage.

"We offer no panaceas for alleviating this situation in the pages of this report. Indeed there are none! We have no pat solution to the issues we present you with here. We have not written with the smugness or the self satisfaction of the research scholar or academician. But we feel that if you study this report, the chances are good that you can probably save yourself some engineering dollars, and at the same time make a concrete contribution to alleviating the shortage of technical personnel faced by the nation."

We intend to study this report and write more about it in an early issue.

SALARIES

. . . *Still Telescoping*

Three news stories crossing our desk this past month point up how engineers' salaries are rising, but telescoping at the same time.

Total compensations of chemical company presidents are holding level and even decreasing. Middle management compensation is up just enough to beat out the cost of living by a percentage point or two. But starting salaries for new engineers are running away faster than ever.

Starting from the bottom, we have an analysis from Lehigh Univ., Bethlehem, Pa., on the 1957 crop of chemical engineering grads. They started work this June at salaries averaging $460/month. This represents a boost of 12% over a year ago when the average starting salary was $410/month, according to Everett A. Teal, director of placement and counseling services at Lehigh.

Teal's report shows that 446 interviews were held on the Lehigh campus for 33 chemical engineering majors by personnel men from 103 companies. Of these 33 chemical engineers, seven turned down job offers to go on to graduate schools, and one will go into military service.

What's happening to the lucky fellows in the middle shows up in a study just released to subscribers by American Management Assn.'s Executive Compensation Service. Surveying 6,000 middle-management executives from 239 companies, AMA reports that three fourths of the individuals included in the survey sample received salary increases last year. Over-all increase in their level of compensation was 5.8%. Individuals included hold responsible positions in marketing, production, finance, law, purchasing, industrial relations, engineering and research.

Maybe 5.8% is a decent annual raise for a middle-management executive these days. However, when stacked up against cost of living, it may leave something to be desired. In April 1956 cost-of-living index stood at 114.9; jumped to 119.3 by April 1957. That's a 4.4% hike.

At the very top, chemical company presidents weren't making out so well last year. Except for Morse G. Dial of Union Carbide, chemical companies held top executive salaries level or even decreased them. Dial moved from $262,500 to $383,386. Eastman Kodak held T. J. Hargrave, chairman, and A. K. Chapman, president, at about $210,000 each. Crawford Greenewalt of DuPont dropped from $642,619 to $600,886. K. C. Towe of American Cyanamid went from $170,032 to $177,503.

Naturally, many of these top figures are clouded by deferred compensation plans and stock options. Generally, though, with the top holding level and the bottom surging upward, engineering salaries continue to telescope down the middle.

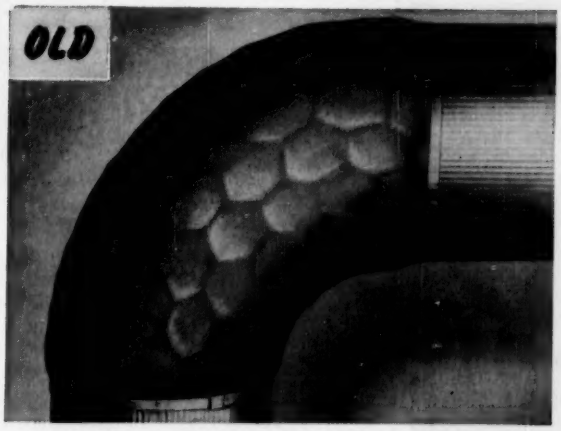
INSURANCE

. . . *for Business Travel*

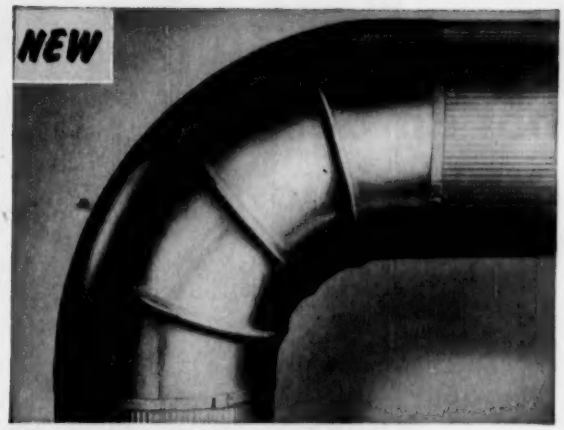
More and more companies are providing employees with a special kind of insurance to protect them in the event of death or injury during business travel.

Travel accident insurance, which is usually carried in addition to the company's regular group insurance benefits, is provided by more than half the respondents in two recent surveys by national business associations (*Management Review*, July 1957, p. 39).

Some companies limit travel insurance to airplane trips. This policy customarily covers employees traveling on either scheduled or nonscheduled airlines, and includes closely related accidents.



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Childers Announces New Aluminum Elbow Jacketing For Insulated Lines

Revolutionary new Childers Ell-Jacs go on fast and easy . . . fit perfectly . . . cut installation costs . . . never need painting . . . and, used with Childers Jacketing, give your insulated lines that well-dressed look from end to end.

Now, aluminum elbows are made in a wide range of sizes by America's leading manufacturer of aluminum jacketing. Childers Aluminum Ell-Jacs are available for quick, easy application to protect costly elbow insulation.

Childers Ell-Jacs, together with Childers Jacketing, enable you to install maintenance-free aluminum over every square foot of your valuable insulation. You protect *all* of your insulation investment at lowest cost. You get the bonus of a better looking plant and easier housekeeping. Aluminum *keeps* its new look, needs no expensive periodic painting.

Positive weather-proofing, too, is assured by exclusive Childers Lap-Seal (Patents Pending). Factory-attached moisture barrier prevents harm to the underneath side of the aluminum.

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You also get greater strength and greater protection because Childers Jacketing is cross-crimped.

It's easy to install Childers Jacketing. All you need are pliers and screwdriver, plus inexpensive strapping. Two men can do the job. Jacketing can be removed for inspection of the lines, then reapplied without waste.

Why not benefit from Childers world-wide experience when you buy insulation for your lines, towers, vessels, and tanks? More than 2,000 petroleum refining, petro-chemical, and chemical plants will endorse your decision. Childers Engineering Representatives, located in 27 major industrial centers, give professional advice on insulation jacketing.

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EXCLUSIVE LAP-SEAL, available at no extra cost, is a series of 8 ribs rolled into the underlapping edge of the jacketing, providing automatic measure of the 2" circumferential lap. Proper lap is assured without waste. Labor is saved. Where desired, a positive weather seal is easily made with Lap-Seal and a mastic.



DEEP CORRUGATED Childers Jacketing in 1¼" and 2½" corrugations is recommended for permanent protection and improved appearance of insulated towers, vessels, tanks. Deep Corrugated Jacketing with factory-attached moisture barrier is another product available only from Childers.

See Childer's ad in Sweet's Industrial Construction File, Chemical Engineering Catalog and Refinery Catalog.

New QUAKER hose for hot air ducting cuts heat loss up to 57%



Synthetic fabric jacket and silicone tube retain temperatures from upstream to downstream end

Made in continuous lengths up to 50′, this new Quaker hose easily withstands temperatures as high as +450°F; as low as −80°F.

As the above diagram shows, the hose keeps heat loss—and therefore energy loss—to a minimum. (Comparable outside temperature of ordinary hot air ducting material, such as stainless steel, would be about 400° F.). Both the silicone tube and the synthetic fabric jacket of Quaker's new hose hold the heat!

Other advantages? The hose is lightweight and fully flexible. And it resists abrasion.

Available in either single or double jacket, the hose comes in 1″ to 4″ I.D.'s. Sizes 1″ and 1¼″ I.D. can be made in 30′ continuous lengths; 1½″ to 4″ I.D. in 50′ lengths. The hose takes regular expansion and shank hose couplings.

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Pioneer Works,
Pittsburg, Calif.

QUAKER RUBBER DIVISION
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PEOPLE . . . TECHNICAL

A Valuable Cross Section

THE CHEMISTRY OF ORGANOMETALLIC COMPOUNDS. By Eugene G. Rochow, Dallas T. Hurd and Richard N. Lewis. John Wiley & Sons, New York. vii and 344 pages. $8.50.

Reviewed by F. C. Nachod.

The fact that carbon forms bonds with metal atoms has had a profound impact on chemical technology. Synthesis involving Grignard reagent or lithium aluminum hydride are as common as the use, for example, of mercurials in the armamentarium of modern medicine.

In this book, the authors have assembled a cross-section (but not a compendium) of our present knowledge of carbon compounds containing a metal bond. After reviewing valence theory and the complexity of "percent ionic character," they deal with preparative techniques and then systematically treat compounds of the elements of group II to VII and transition metals.

Practicing chemists and chemical engineers will find the last two chapters, namely "Organometallic Compounds in Organic Synthesis," and "Special Types of Organometallic Compounds," of particular interest.

The book will be of great value in the graduate curriculum as well as in the industrial laboratory, and is recommended to workers in either location.

For Problem Solvers

PLANT AND PROCESS DYNAMIC CHARACTERISTICS. Proceedings of a conference of the Society of Instrument Technology. Academic Press, New York. 246 pages. $8.80.

Reviewed by P. S. Buckley.

In the last five or ten years there has been a growing interest in applying quantitative

BOOKSHELF

J. B. BACON

techniques to the design of chemical and petroleum plant control systems.

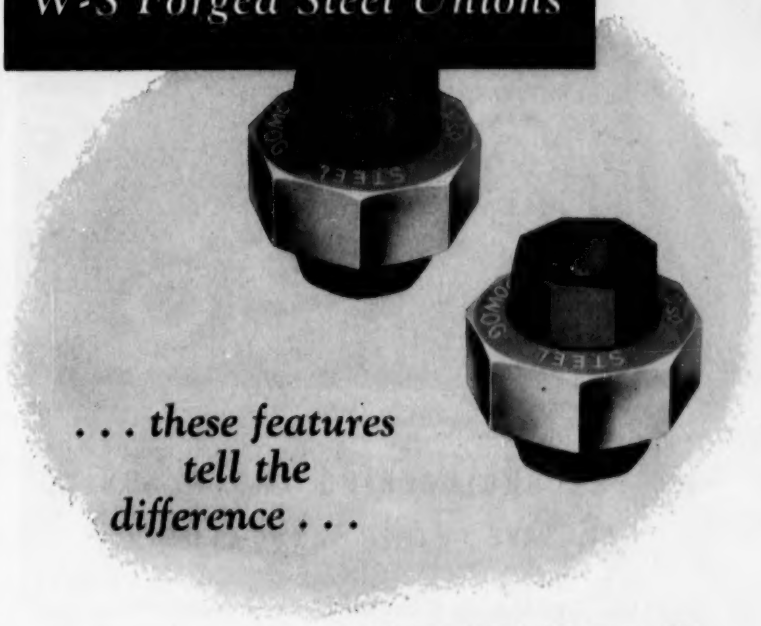
Engineers want to know not merely how to apply instruments most effectively but also how to design plants to be more controllable. The most advanced techniques require that the unsteady-state characteristics of the instruments and of the process be expressed as differential or difference equations.

As this book shows, however, it is often possible with process control systems, as with servomechanisms, to use an approach which requires less knowledge of mathematics and less computation. Frequency-response techniques permit rapid design of control systems or prediction of control system stability by methods which are largely graphical and require only a slide rule and a couple of simple templates.

When an engineer sits down to apply these methods to a particular problem, one of the first things he usually discovers is that he lacks the equations or the frequency response data for the process. Most of the papers in this book are concerned with remedying this lack. The first two involve heat exchangers, in one case a jacketed pan (kettle), in the other, a natural-recirculation, vertical-tube reboiler. In both instances it is shown that the frequency response may be obtained by experiment or by a theoretical procedure based on linear, ordinary differential equations. The latter method is particularly useful when a process is in the design stage.

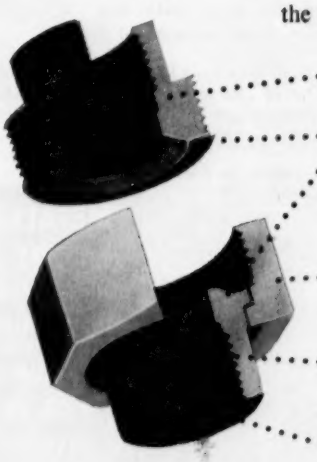
Composition response in a distillation column to upsets in feed composition is the subject of the next two papers. Both theoretical and experimental procedures were used, with reasonable agreement between the two. Qualitatively, the results of both papers were about what one would expect (e.g., increasing the condenser holdup makes the top tray composition response more sluggish). The value of the papers is in demonstrating that

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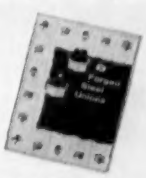
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*This illustration is an authentic engraving of a laboratory used by alchemists in Holland during the 1600's. For your copy (11"x15") of this reproduction, write on your company letterhead stating your name and title.

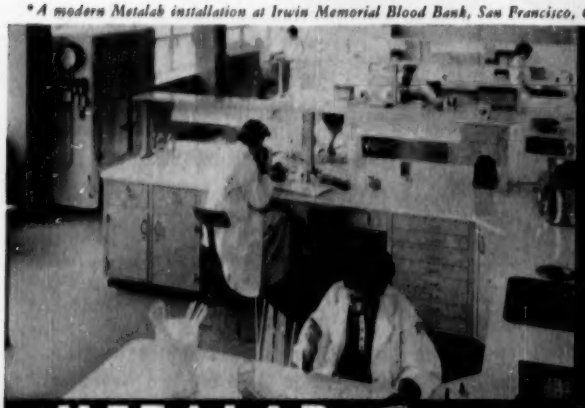
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relatively simple equations can be used to predict the dynamic effect of small deviations from average feed composition. While considerable progress has now been made on distillation dynamics, much needs to be done on the effects of upsets in feed temperature, steam header pressure, cooling water header pressure, reflux and removal rates.

One of the more interesting papers is concerned with the dynamics of pH electrodes and some simple reaction systems. The latter half of this paper compares the theoretical frequency response of simple neutralization systems with the experimentally determined frequency response. Agreement between the two is fair.

The remaining papers are concerned mostly with the techniques of measuring process dynamics (usually frequency response) of existing plants either by deliberate upsets or by statistical analysis of normal operating data. One paper demonstrates the application of an analog computer to a cascade level-flow control system which unfortunately is so simple that it could be easily handled by pencil-and-paper methods.

By and large, this book is a valuable addition to the library of any engineer who is seriously interested in process dynamics and process control.

For Problem Formulators

APPLIED MATHEMATICS IN CHEMICAL ENGINEERING. 2nd ed. By H. S. Mickley, T. K. Sherwood and C. E. Reed. McGraw-Hill Book Co., New York. 413 pages. $9.

Reviewed by Leon Cooper

This second edition represents a solid advance over the first edition, published in 1939.

Since that time, chemical engineering journals have exhibited increasing preoccupation with more sophisticated mathematical techniques to elaborate basic problems of chemical engineering.

This book attempts to show the reader the most useful mathematical techniques for such

problems and exhibits their use in many well chosen examples. It will be most useful to those chemical engineers engaged in research and certain aspects of design rather than to engineers in production.

The first chapter concerns the treatment of engineering data. Such topics as the use of empirical equations, interpolation and numerical and graphical differentiation and integration are covered.

Chapter two discusses the nature of errors in interpreting engineering data, the analysis of variance and the design of experiments. The treatment, of necessity, is brief, and collateral reading will certainly be required. But it calls attention to statistical principles which are too seldom used at present.

The third chapter considers mathematical formulation of physical problems and mathematical expression of the basic laws used by chemical engineers —the laws of conservation of mass and energy and the laws involving the rates at which heat transfer, mass transfer, chemical reaction, etc., take place. Examples in this chapter are good and the discussion is easy to follow.

Chapters four and five summarize methods of solving ordinary differential equations: classical methods of closed-form solutions and methods of series and numerical solutions.

In Chapter six and seven are discussed the use and formulation of partial differential equations, vector methods in formulating problems, and classical methods for solving partial differential equations, especially in terms of sine expansions of orthogonal functions. The well-known examples of heat and mass diffusion are considered.

The Laplace Transform, its properties and its uses in the soultion of ordinary and partial differential equations, are treated in the next chapter. It is surprising that the authors fail to give an example where Laplace transforms find the widest use, namely, in automatic process control theory.

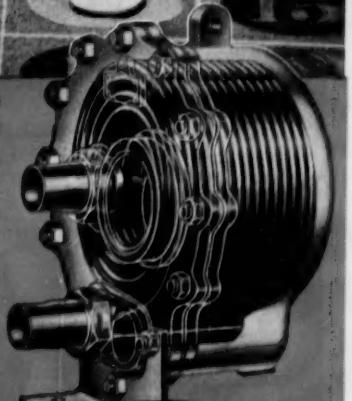
Chapter nine briefly explains the use of the calculus of finite



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differences in the analysis of stagewise chemical processes.

The final chapter is concerned with a difficult but important subject: the numerical solution of partial differential equations. Several methods are illustrated by applying them to problems in heat transfer, where these methods have had widest application.

This book will be most helpful to formulators of problems, to people concerned with analyzing some physical situation mathematically. It can be recommended to all chemical engineers who want to see how the basic approach to solution of chemical engineering problems is being altered by more advanced mathematical techniques.

BRIEFLY NOTED

ASTM PROCEEDINGS, 1956 *ed.* 1,510 *pp. American Society for Testing Materials,* 1916 *Race St., Philadelphia* 3, *Pa.* $12. Chronicles activities of ASTM for the year 1956. Includes technical reports and papers with discussions.

ASTM STANDARDS ON RUBBER PRODUCTS. 832 *pp. American Society for Testing Materials,* 1916 *Race St., Philadelphia* 3, *Pa.* $7. Tells how most meaningfully to beat, squeeze, chill, age, pull, heat, react and describe rubber products. Includes rubber-coated fabrics, synthetic elastomers, nonrigid plastics and latex foams.

CRITICAL DATA TABLES. 450 *pp. Corn Industries Research Foundation,* 1001 *Connecticut Ave., Washington* 6, *D. C.* $4. Contains most complete compilation to date of tables, charts and graphs pertaining to corn refining industry.

CORROSION AND WEAR HANDBOOK FOR WATER-COOLED REACTORS. 293 *pp. Superintendent of Documents, U. S. Government Printing Office, Washington* 25, *D. C.* $2.25. Gives solutions of engineering problems resulting from use of water as heat transfer medium in nuclear reactors. Data are from Nautilus and Shippingport projects.

EFFECTS OF NUCLEAR WEAPONS. 579 *pp. Compiled and edited by Samuel Glasstone. Superintendent of Documents, U. S. Government Printing Office, Wash-*

ington 25, *D. C.* $2. Brings up to date the previous "Effects of Atomic Weapons," provides a comprehensive summary of current knowledge on the effects of nuclear weapons.

EXPERIMENTAL BOILING WATER REACTOR. 233 *pp. Superintendent of Documents, U. S. Government Printing Office, Washington* 25, *D. C.* $2.25. Gives a detailed description of the EBWR, includes design calculations.

1957 ISOTOPE INDEX. 100 *pp. Scientific Equipment Co., 23 N. Hawthorne Lane, Indianapolis* 19, *Ind.* $3. Gives sources and purchasing information for all commercially available isotopes as of April 1, 1957, includes sections on available calibration samples, radiographic and therapeutic sources.

PHASE RELATIONS OF GAS-CONDENSATE FLUIDS. Vol. I (Test Results, Apparatus and Techniques). 439 *pp. American Gas Association, 420 Lexington Ave., New York* 17, *N. Y.* $10. Describes 20-year Bureau of Mines study of fluids in high-pressure reservoirs. Volume II, now in preparation, will describe correlations of test results.

POLYTHENE: THE TECHNOLOGY AND USES OF ETHYLENE POLYMERS. 642 *pp. Edited by Archie Renfrew and Phillip Morgan. British Publications Inc., 30 E. 60 St., New York* 22, *N. Y.* $18.50. Critical appraisal includes history, manufacture, structure, properties, methods of fabrication and applications.

PROCEEDINGS OF THE 1957 NATIONAL INDUSTRIAL RESEARCH CONFERENCE. *Order from: Mrs. Alice Jones, NIRC—II, Armour Research Foundation, 10 W. 35 St., Chicago 16, Ill.* $6. Papers deal with more research for the dollar, sales growth and dividends from research.

MORE NEW BOOKS

TECHNIQUE OF ORGANIC CHEMISTRY, VOL. 10. FUNDAMENTALS OF CHROMATOGRAPHY. Edited by Arnold Weissburger. Interscience. $9.75.

INTRODUCTION TO ORGANIC CHEMISTRY. By Fieser and Fieser. D. C. Heath. $7.

THERMODYNAMICS. By E. A. Guggenheim. North-Holland. $9.75.



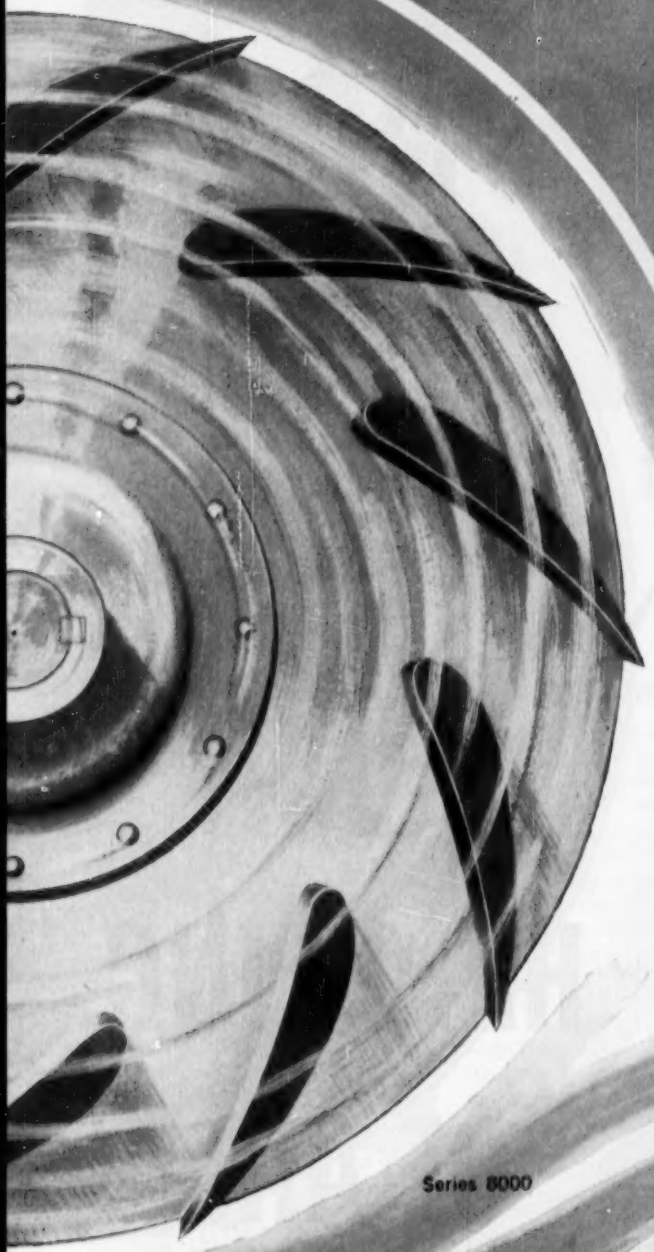
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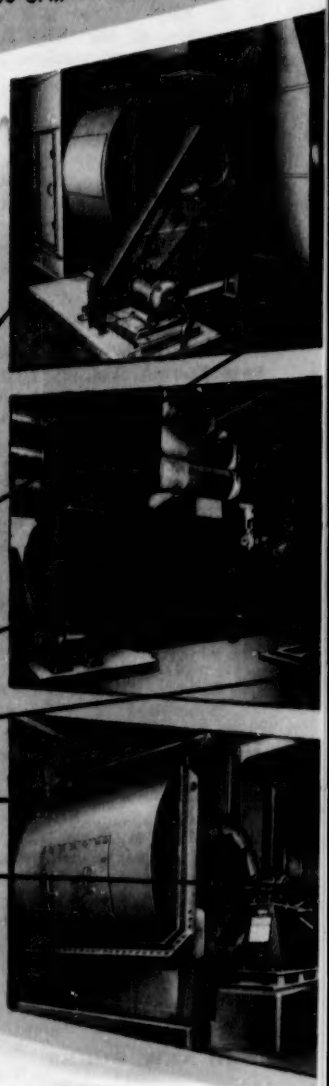
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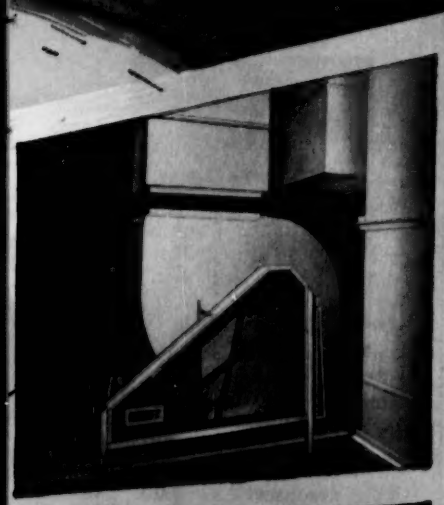
1 Building Ventilation
2 General Supply and Exhaust
3 Conventional and High Pressure Air Conditioning
4 Vehicular Tunnel Ventilation
5 Industrial Processing
6 Combustion Air Supply

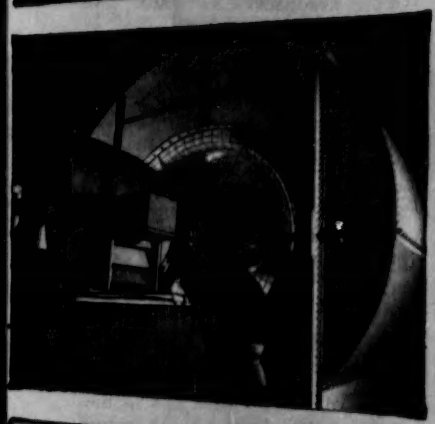


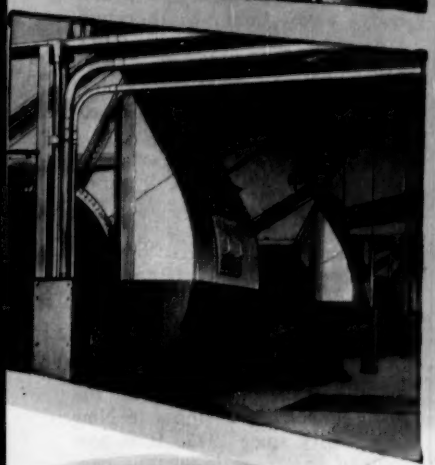
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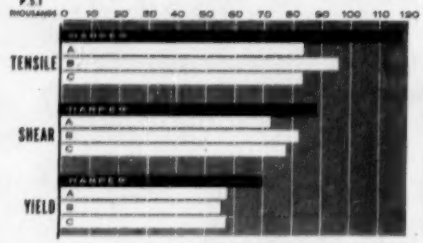
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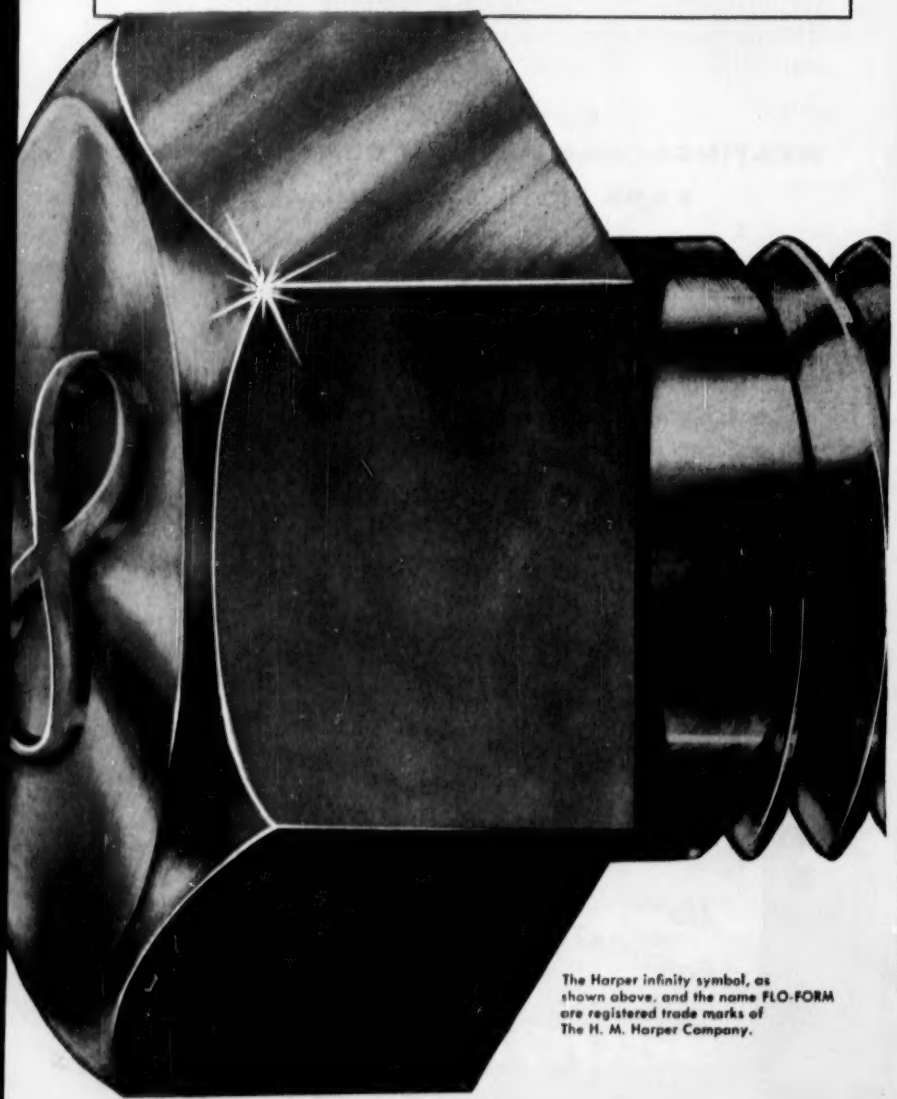
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PEOPLE . . .

MEET YOUR



James P. O'Donnell

HOW FLOWSHEETS COMMUNICATE ENGINEERING INFORMATION. PAGE 249

For many years, CE editors have been trying to find an author who could give us what amounts to a flowsheet on flowsheets. That is, someone who could tell engineers—in article form—about all the different kinds of flowsheets in use and for what purpose each can best be utilized.

We've tried to get this material for two reasons. The first is obvious: Since flowsheets comprise the most efficient means of communication among engineers, it's about time that somebody gave them a thorough treatment in print. The other reason is a follow-up of the first: To our knowledge, engineering literature lacks a thorough explanation of the subject.

So, one day when James P. O'Donnell and editors Fremed and Olive sat down to lunch, the outline for the current report was drawn up. The goal: to trace the progress of the setting up of a chemical process operation from start to finish by means of the flowsheets which recorded that progress.

O'Donnell has operated his own consulting business in New York City since 1945. It is now one of the most important consulting firms in its field. The organization specializes in the petroleum, petrochemical and chemical industries.

AUTHORS

M. A. GIBBONS

Before setting up his own practice, O'Donnell spent ten years working with M. W. Kellogg Co. He is registered as a professional engineer in New York and in six other states.

Besides the primary responsibilities he shoulders involving his own practice, O'Donnell is director of the Association of Consulting Chemists and Chemical Engineers, recently elected national director from New York State to the National Society of Professional Engineers, and a member of the New York State Association of Consulting Engineers.

O'Donnell studied at Cooper Union Institute of Technology and at the University of Illinois where he earned B. S. and M. S. degrees respectively. He is a member of Tau Beta Pi and Sigma Xi.

As to spare time activities, O'Donnell reports that his two teen-age daughters take up any time which might ordinarily be left for personal hobbies.



Herbert E. Mills

INDEX TO ESTIMATE COST OF BELT CONVEYORS. PAGE 242

Herbert E. Mills' realization that there was a need for a quick workable method of estimating installation time as well as the cost of materials handling equipment prompted the current article. (*Continued*)

HARPER

CORROSION-RESISTANT FASTENINGS

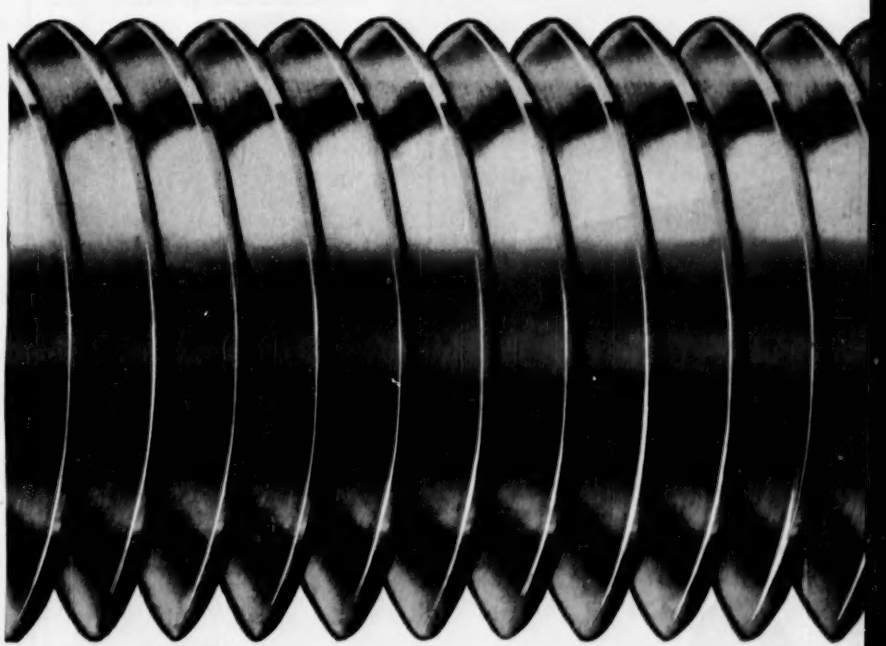


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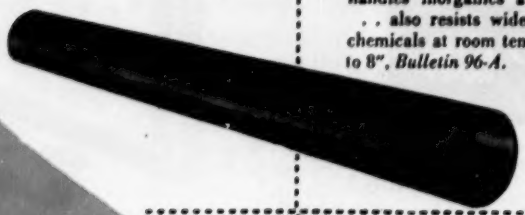




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Heat-resistant nitrile hard rubber pipe handles inorganics at 250-275 deg. F. . . also resists wide range of organic chemicals at room temperature. Sizes 1" to 8". *Bulletin 96-A.*

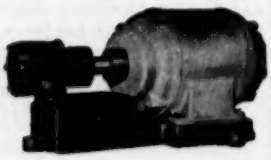


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ACE processing equipment of rubber and plastics

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AUTHORS . . .

It was no accident, however, that he became interested in these problems. At present, Mills specializes in estimating materials handling equipment for General Chemical Division, Allied Chemical & Dye Corp., in Camden, N. J.

What's more, he has always been interested in work simplification and accuracy on the job. In fact, he has worked on time and motion studies, methods and estimating problems with various industrial firms for the past twenty years.

And, when he gets a chance, he occupies himself by organizing data for a book on materials handling estimating which he hopes to publish eventually.

Mills studied industrial management at Temple University. During World War II, he spent three years in Europe as a tactical airborne supply technician.

Hobbies — highly constructive ones at that — include cabinet making and building high fidelity equipment.



E. Alfred Burrill

PARTICLE ACCELERATOR. PAGE 235

Early this year, E. Alfred Burrill was promoted to the post of sales manager for High Voltage Engineering Corp. The appointment came as a result and in recognition of ten years fine service with the organization.

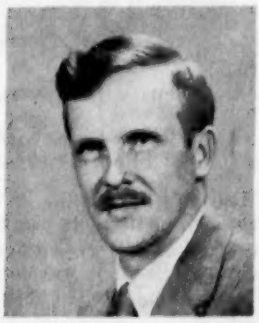
Burrill joined the organization in 1947 as a physicist. But his first association with the firm actually dates back much earlier. While he was still at MIT, Burrill worked in the High Voltage Laboratory, under R. J. Van de Graaff, on nuclear phys-

ics, supervoltage radiography and particle-accelerator design. This experience, which dates from 1939, gives Burrill a total of some 18 years association with particle-accelerator problems.

Memberships include the American Physical Society, the Atomic Industrial Forum, The American Association for the Advancement of Science, The American Nuclear Society, the Society for Nondestructive Testing, and the American Society for Testing Materials.

In connection with the latter organization, Burrill earned the Charles B. Dudley Medal. He also won a Naval Ordnance Award.

Burrill was born in Brocton, Mass., forty years ago. He received his B. S. degree at MIT, in his native State. Married now, with two children, Burrills live in Weston, Mass.



Ralph Cushing

YOUR DESIGN REFERENCE FILE. PAGE 277

Author Cushing reports that he'll soon move from St. Louis, Mo., to Pittsburgh, Pa., along with Mobay Chemical Co., where he works as a design engineer.

When he gets settled in the new locale, he plans to take on some graduate work in chemical engineering at the University of Pittsburgh and perhaps do some part-time teaching.

Cushing joined Mobay Chemical a little over a year ago. Before that time, he taught plant and equipment design to seniors at Syracuse University and also worked for Bristol Laboratories, Inc., in the same city.

During the last war, Cushing

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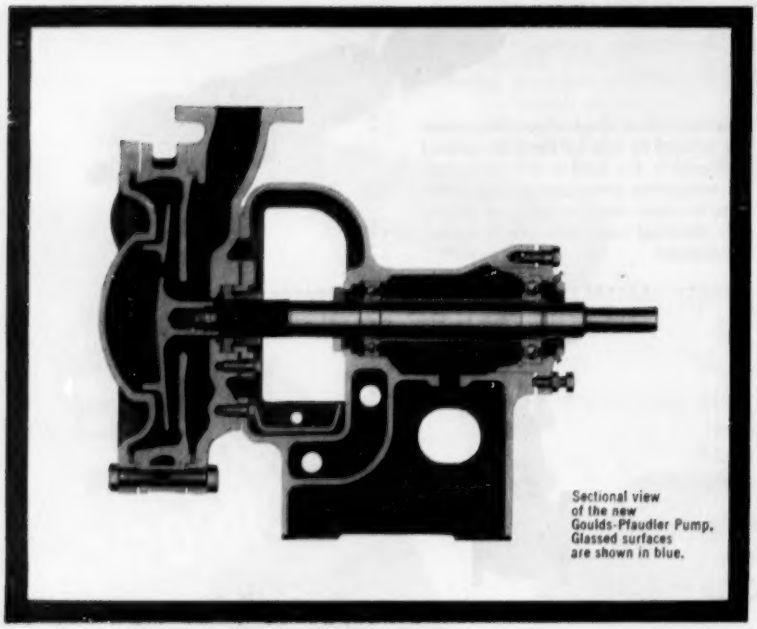
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Sectional view of the new Goulds-Pfaudler Pump. Glassed surfaces are shown in blue.

...*pump corrosives in* **glass**

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Here's a centrifugal pump that lasts *for years* handling the most corrosive chemicals.

All liquid-contacting parts on this new Goulds-Pfaudler pump are glassed. This glass is resistant to all acids except hydrofluoric up to 212° F. and higher in many cases, as well as to many mild alkaline solutions.

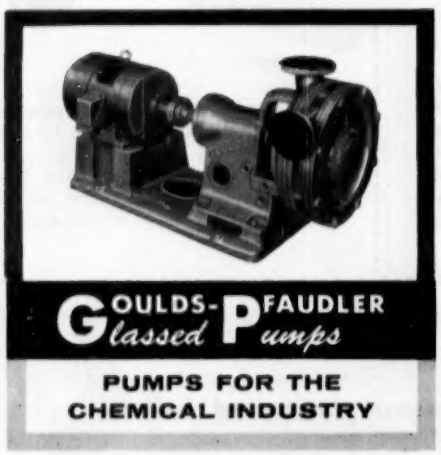
Besides getting superior corrosion resistance, you can handle sticky materials better, too, with the Goulds-Pfaudler glassed pump. Many plastics and synthetic rubbers and other materials that cling to metal, flow smoothly through this new pump.

Tough glass-metal surface

The glassed surfaces are tough—the powerful mechanical and chemical interlocking of the glass and metal provides an inseparable bond—the glass can't crack or shatter!

Most important, the Goulds-Pfaudler glassed pump costs less than you might think; less for example, than some special-alloy pumps. If you're pumping corrosives, this new pump's high efficiency and long life are almost sure to bring you substantial savings.

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AUTHORS . . .

was a member of the OSS. Afterwards, he joined the US Air Force in Labrador as member of a parachute rescue team.

Cushing is a licensed Methodist minister, Sunday school teacher and active youth worker. Among his other widely assorted interests, he lists food catering and cake decorating along with photography and horticulture.

For a more thorough rundown of his obviously interesting career, see our previous writeup in the March 1957 issue of *Chemical Engineering*, p. 326.



F. C. Jelen

CONSIDER INCOME TAX IN COST ANALYSES. PAGE 271

The first time F. C. Jelen wrote an article on capitalized costs (*Chemical Engineering*, February 1954) it was done out of a need he himself had for the material.

Since that time, hé has been extending the method he developed to make it as complete as possible. Hence, the wealth of other cost information (*Chemical Engineering*, August 1955, May 1956, June 1956) which has appeared since that time.

Jelen has extended his presentation of cost information to make good use of the lecture method. He has appeared on the programs of various organizations from coast to coast. And, in February 1956, at a Los Angeles AIChE meeting, he received an award for the best presentation of a paper.

Among his many hobbies, Jelen lists boating, radio and climbing. The first two he combines as a member of the U. S. Coast Guard Auxiliary. For his outfit, he operates a radio trans-

mitter in the net, serves as a division communication officer and holds the rank of Flotilla Commander. Jelen also has a first class commercial radiotelephone license.

Like many other authors, Jelen has not ignored teaching as a worthy and important occupation. Recently, he taught a course in chemical engineering economics at University College, Syracuse University.

The Jelens have two girls, aged 5 and 10. They live in Syracuse, N. Y.



William E. Ball

CE REFRESHER: MATHEMATICS. PAGE 284

Like Co-author Johnson, William E. Ball geared his work for the mathematical series so that it could be of the best possible use to the practicing engineer.

Under Johnson's supervision, Ball aimed at whipping the mathematical material—to which most engineers are exposed—for digestion by today's engineers, with emphasis on the formulation and solution of practical applied problems.

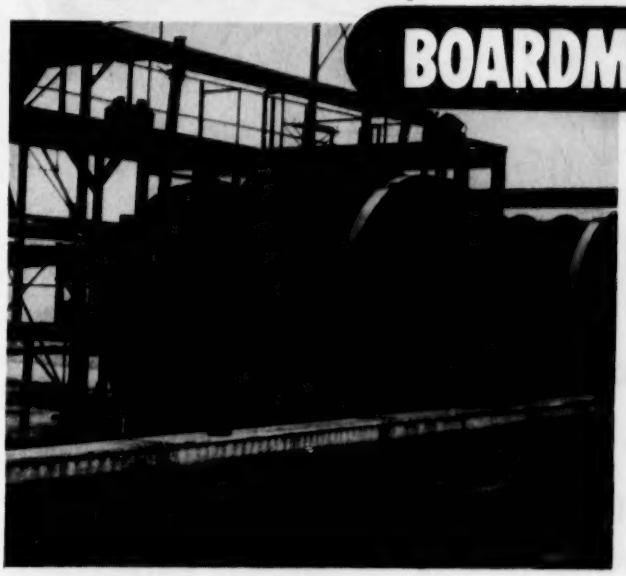
Currently, Ball is working on his doctorate in chemical engineering at Washington University. So far he has put in three years of graduate work and expects to get his degree at the end of the fourth. He earned a B. S. at the University in 1952.

Besides his heavy schedule at the school, Ball works as an applied science representative for International Business Machines Corp. Last year, he also worked as a computer programmer for Socony Mobil Oil Co. And, he gleaned further experience in the field while still in the Army:

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AUTHORS . . .

He spent two years in the Chemical Corps as an engineer engaged in process development work.

Ball is a member of the AIChE as well as the Ass'n of Computing Machinery.

Among his hobbies and interests, he lists chess, photography, Hi-Fi and archery—especially field archery and hunting.



R. Curtis Johnson

CE REFRESHER: MATHEMATICS. PAGE 284

Engineering today is becoming more an exact science than ever before. So say Authors Johnson and Ball. And, with this in mind, they designed the current series to enable old timers to bring their mathematical background up to a level with newly graduating engineers.

Because of their belief in the coming "mathematical age" of engineering, both authors feel that all practicing engineers should have a keen interest in the current series. It should give them a good start on the road back to mathematical competence.

This isn't the first time that R. Curtis Johnson has turned out serious writing in the field. In fact, he has authored about fourteen other publications, mainly in applied mathematics and on computers. Along with Edwin T. Williams, he will soon chalk up a stoichiometry text, to be published next year by the McGraw-Hill Book Co.

Right now, Johnson is an associate professor in the chemical engineering department of Washington University, in St.

Louis, Mo. He has been on the school's faculty for the past six years.

Johnson has also done his share of consulting. Most recently, he has worked on process simulation and control in a new department at Monsanto Chemical. And he serves as director of scientific computation for Compumatix—a newly formed St. Louis firm—devoted to systems analysis and automatic computation.



O. A. Battista

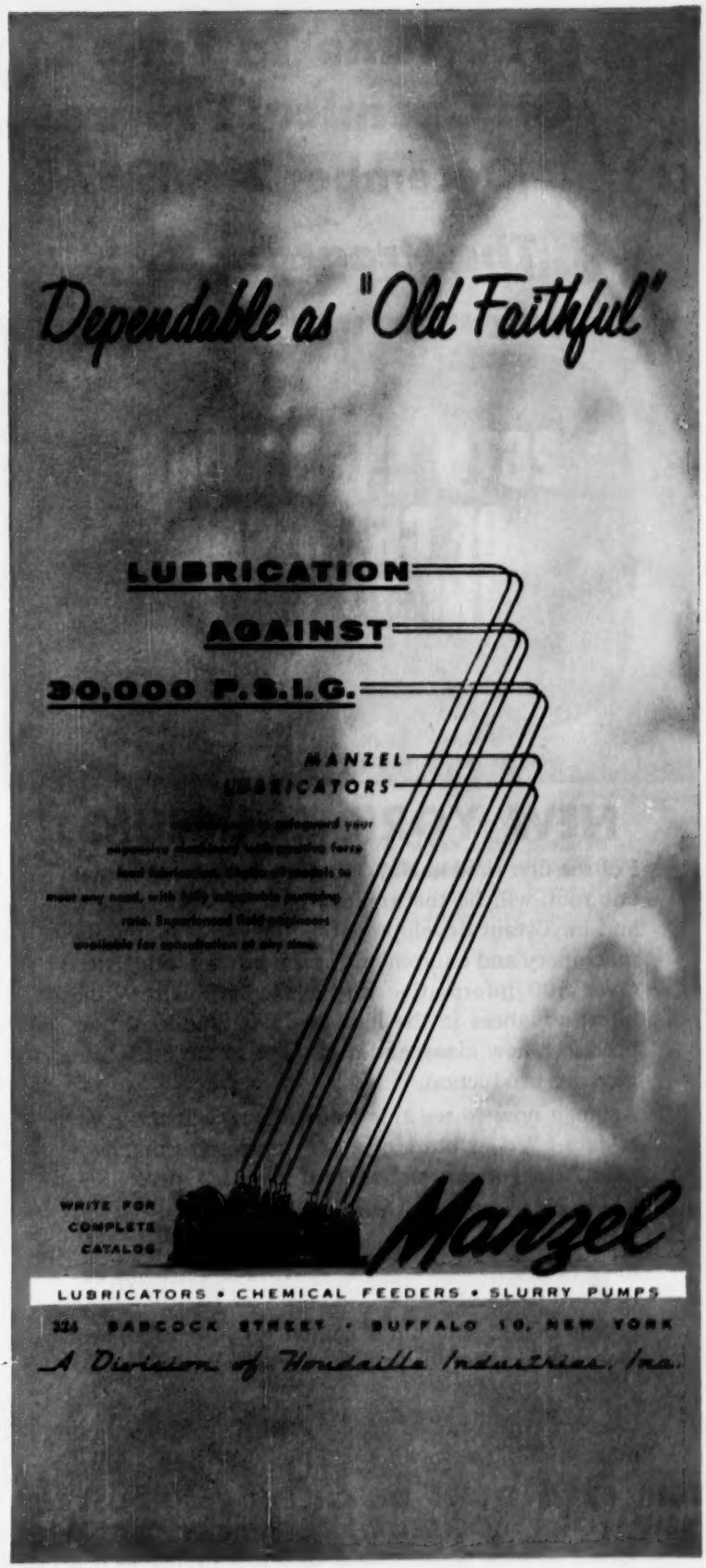
HOW TO ENJOY WORK WHILE ON THE ROAD. PAGE 321

In case your job ever requires that you travel on an expense account, O. A. Battista is the man to give you the best possible tested travel tips. And that's just what he does in the current article "How to Enjoy Work While on the Road."

The article is actually a chapter from his new best-selling book "How to Enjoy Work and Get More Fun Out of Life," and it is *the* chapter in the book which we thought would be of most interest to readers of *Chemical Engineering*.

When he's not busy writing, Battista is head of American Viscose's analytical group, research and development division. He first joined the firm in 1940 as a research chemist and later was advanced to the post of senior research chemist.

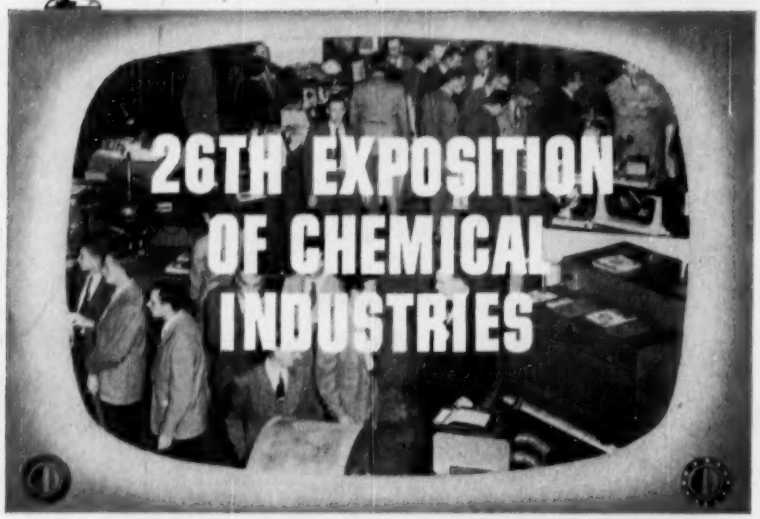
Before his association with AVC, Battista had worked with the late Professor Harold Hibbert at the Pulp & Paper Research Institute of Canada, in Montreal.



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December 2-6, 1957

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PEOPLE . . .

LETTERS:

New Friction-Loss Data

Sir:

Prof. Dale S. Davis' article on friction losses in paper stock suspensions (April 1957, p. 294) implies that the data of Brecht and Heller are supported by data gathered at the Univ. of Maine.

This is not correct. Work at the university indicates an average deviation of plus 65% for Prof. Davis' nomograph, with individual points running as high as 231%.

The Hydraulics Committee of the Technical Association of the Pulp and Paper Industry has been sponsoring a research project at the University of Maine for the past eight years in an attempt to bring some order out of chaos in the field of friction loss of paper stock in pipes. We have found that the Brecht-Heller data, taken on pulps that were previously dried, cannot be considered valid for paper pulps that have never been dried.

K. J. MACKENZIE
Eastman Kodak Co.
Rochester, N. Y.

Pro: Instrumentation Guide

Sir:

Chemical Engineering should be complimented on its complete "Guide to Process Instrument Elements" (June 1957, pp. 287-320). This is not only meaningful to the chemical industry but of great value to instrument men for training purposes.

It is one of the most complete summaries to be found in any publication, whether textbook or magazine. We have used it for training of college graduates starting on instrument application work. It should be published in booklet form for this purpose. We are ordering 40 copies of your Process Control report to give to our men for this reason.

Each one of your special instrumentation issues has been a major contribution to the instrument industry. They are of utmost value to those in the industry because they are ex-

PRO & CON

C. H. CHILTON

cellent summaries of the state of the art. More important than that, they contact many not directly concerned with instrumentation. Although articles of this sort are published in magazines associated with automatic control, their circulation is usually limited to those in that field.

Spreading the word about instrumentation—clearly and concisely—must be done. Yours is one of the most effective ways. This information, in the hands of the chemical engineer, will make the instrument engineer's task considerably easier.

I am looking forward to your 1960 Process Control report.

W. A. CRAWFORD
E. I. du Pont de Nemours & Co.
Wilmington, Del.

► *Reprints of both the complete June 1957 Process Control Report (No. 95, $1) and the Guide to Process Instrument Elements (No. 96, 50¢) are available; use the Reader Service cards.*—ED.

Pro: Application Photos

Sir:

Having recently changed jobs, I enjoyed reading T. K. Kelly's article, "Changing Jobs in Today's Turbulent Market" (July 1957, pp. 301-304).

While Mr. Kelly's article is most worthwhile, even in retrospect, I cannot agree with his recommendation that the application photo be omitted from your resume.

Irrespective of the legal situation of the employer, I am sure that employment managers, vice presidents, sales managers and research directors would like to get a look at the product they are buying. The photograph, in my opinion, is simply good sales presentation when you are selling your most important product—yourself.

If you submit an unsolicited resume, the inclusion of your photograph should not be a breach of the law. If the employer does not ask for a photograph, you might send a resume

be sure

you match pumping

Efficiency

to the job...

Maximum head and delivery as compared to power consumed are the big factors in pumping efficiency. So regardless of the type of pumping job you have, you want a unit that gives the best results. You can't go wrong when you specify an Ingersoll-Rand Motorpump . . . available in a wide range of models from ¼ through 75 horsepower . . . capacities to 2800 gallons per minute . . . heads to 650 feet.

Motorpumps are compact, easy to install units with a versatility of mounting positions. Full details on I-R Motorpumps will be furnished promptly by your nearby Ingersoll-Rand branch office, or write direct for the latest catalog.

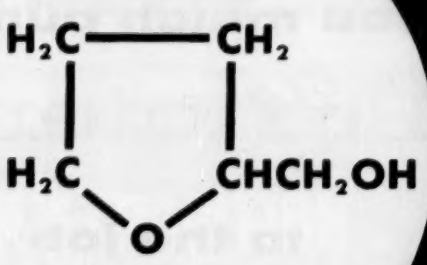
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Ingersoll-Rand
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9-670

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To aid you, we offer a comprehensive book packed with information about THFA—its chemistry, physical properties, uses and other valuable data. It's yours for the asking.

Write for Bulletin 206

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CHEMICALS DEPARTMENT

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In Australia: Swift & Company, Ltd., Sydney
In Japan: F. Kanematsu & Company, Ltd., Tokyo

along with the completed application form to cover any points the application form misses. In that way you have relieved the prospective employer of any breach of the law.

Perhaps this sounds a bit like evading the antidiscrimination laws, but if an employer is going to discriminate for one type of prejudice or another it might be better to let him do it before you waste your time and his with a personal interview.

Besides, who would want to work for such an intolerant person? More than likely this type of intolerance carries over into other areas, and I wouldn't want my promotion to hinge on the color of suit I wore last week.

GEORGE V. VOSSELLER
General Abrasive Co.
Niagara Falls, N. Y.

▶ *We have checked into the New York State law on the question of application photos. Although it is illegal for the employer to ask for a photo, there are no restrictions on the voluntary submission of a photo by the applicant.*—ED.

Pro: Filing Ease

Sir:

The increasing readability and usability of *Chemical Engineering* suits me to a T. Because I check each issue from cover to cover and remove for filing every article or item of special interest, I am particularly interested in having each article available as a complete, compact and separable unit. Your 75% achievement figure in this respect is mighty good but here's hoping you hit the 100% mark.

For increased reader convenience in removing articles of special interest would it be possible to offer each subscriber the option of receiving his monthly issue either in the present glued and stapled form or in a new glued, but unstapled, form? If I could get my copy of *Chemical Engineering* in an unstapled form, I could get it apart in a hurry—and without the aid of a screwdriver and pair of pliers. Am I asking for too much?

FRANK A. ANDERSON
University of Mississippi
University, Miss.

▶ *Some of you oldtimers will re-*

member our experiments with an unstapled binding. The pages were easy to remove—so easy that a bit of rough handling in the mails did the job before the subscriber received his copy! McGraw-Hill is doing considerable research in this area, but the results to date haven't been promising.

We will keep on trying to give our readers 100% flexibility with our feature articles and reports. Mechanical limitations and other difficulties, however, will seldom allow us to hit the perfect mark.—ED.

Right Man, Wrong Picture

Sir:

Central Ohio section of the AIChE was pleased to see the writeup in your May issue (p. 335) of Robert B. Filbert, Jr., winner of Columbus Technical Council's Man-of-the-Year award.

I would like to point out a small error. The picture on p. 335 is not Mr. Filbert's picture. The picture shown on p. 338 over the name of Charles J. Strickler is, however, an excellent likeness of Mr. Filbert.

Having served as chairman of the committee which initiated this award, I would be happy to give information on the procedures we used to readers in other parts of the country who may wish to inaugurate similar awards.

GEORGE F. SACHSEL
Battelle Memorial Institute
Columbus, Ohio

▶ *Our apologies to both Messrs. Filbert and Strickler for our inadvertent transposition of their pictures. The two men look so much alike in their pictures that they could pass for twins.*—ED.

Pro: Steam-Purged Chamber

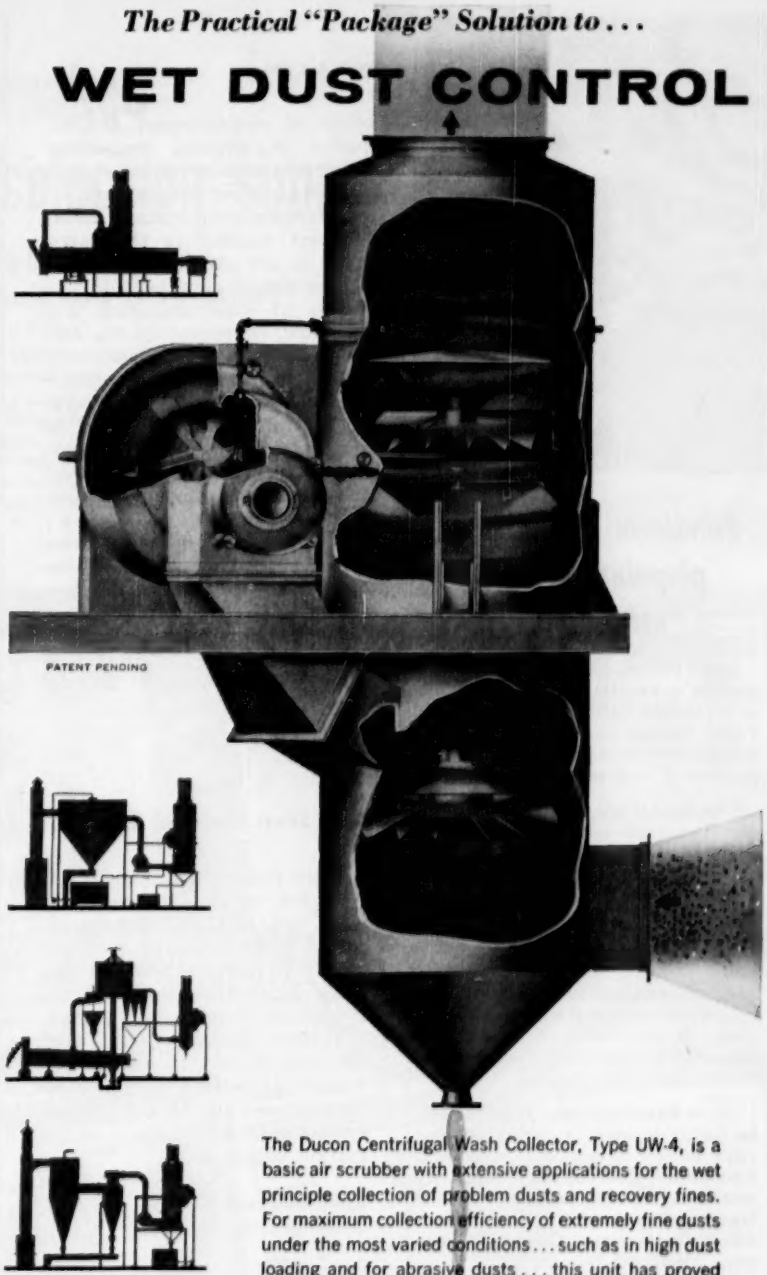
Sir:

F. C. Standiford has noted in the June Pro & Con (p. 381) that they have utilized the boiling-point-rise method of evaporator concentration control as outlined in the February issue (pp. 248-249) without benefit of the steam-purged reference chamber.

This may be acceptable in a given application. However, where accuracy and reproduci-

The Practical "Package" Solution to . . .

WET DUST CONTROL



The Ducon Centrifugal Wash Collector, Type UW-4, is a basic air scrubber with extensive applications for the wet principle collection of problem dusts and recovery fines. For maximum collection efficiency of extremely fine dusts under the most varied conditions . . . such as in high dust loading and for abrasive dusts . . . this unit has proved unexcelled in many types of industrial processes. Unitized construction, precision shop-fitted parts and integrated fan assembly provide simple, rapid installation into the normal processing system.

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Panalarm Annunciator pinpoints process "off-normals"

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One typical adaptation of the modular Panalarm system is engineered to differentiate between the first "off-normal" and subsequent "off-normals" caused by the first. This feature allows instantaneous recognition of the prime source of trouble in a "chain reaction."

Another adaptation is designed specifically for motor start-up and shutdown. It has also been successfully adapted for supervisory control, pump control and programming.

Your Panalarm sales engineer will be happy to make a survey of your requirements to determine whether a Panalarm system can aid productivity and safety in your process. For electrical and mechanical data on standard systems, request Catalog 100B on your letterhead.

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Panellit of Canada, Ltd., Toronto 14

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bility of measurement are required in general evaporator concentration control, the steam-purged chamber is necessary.

Reference temperature measurement directly in the vapor space is not adequate, since the vapors will be superheated. The degree of supersaturation will vary and, consequently, the reference temperature will vary under normal operating conditions. Our test work on evaporator control further indicates that simple removal of this superheat is not sufficient. The presence of varying amounts of noncondensable gases (air) introduced in the evaporator feed or through leaks in the evaporator body will give a fluctuating and unreliable reference temperature measurement.

W. S. SHARSHON
Minneapolis-Honeywell Regulator Co.
Philadelphia, Pa.

Pro: Do-It-Yourself Kits

Sir:

Since publication of my Plant Notebook article in your June issue (pp. 330, 332) I have received many requests from engineers in chemical firms all over the country for more information about do-it-yourself models.

F. Ward Harman Associates of Halesite, N. Y., is now in the process of bringing out a commercial version of this layout system and should have it on the market before long.

WILLIAM B. SPEIR
Rust Engineering Co.
Birmingham, Ala.

Con: Slide Rule Errors

Sir:

In the July installment of the *CE* Refresher, p. 276, Problem 1, the author calculated the head loss F to be 558 psi.

According to my slide rule, this should be 387 psi.

S. K. BRIMACOMBE
Reichold Chemicals (Canada) Ltd.
Toronto, Ont.

▶ *We borrowed a Canadian slide rule from a friend and confirmed Plant Superintendent Brimacombe's* 387 *psi.*—ED.

NOW!
For Immediate Delivery!

Over $1,000,000 In ASCO Solenoid Valves Regularly Maintained In Stock

2-WAY
Normally Closed and Normally Open
Pipe Sizes: ⅛"—2"
Pressures: to 1500 P.S.I.
Voltages: 115-230-460/60
Solenoids: General Purpose, Watertight, Explosion Proof
Services: Air, Water, Oil, Gas, Steam

3-WAY
Normally Closed and Normally Open
Pipe Sizes: ⅛"—½"
Pressures: to 600 P.S.I.
Voltages: 115-230-460/60
Solenoids: General Purpose, Watertight, Explosion Proof
Services: Air, Water, Oil, Gas, Steam

4-WAY
Pipe Sizes: ¼"—1"
Pressures: to 300 P.S.I.
Voltages: 115-230-460/60
Solenoids: General Purpose and Explosion Proof
Services: Air, Water, Oil

HAND RESET
2-WAY
Pipe Sizes: ½"—1"
Pressures: to 250 P.S.I.
Voltages: 115/60
Solenoids: General Purpose
Services: Air, Water, Oil, Gas

3-WAY
Pipe Size: ⅜"
Pressures: to 250 P.S.I.
Voltages: 115/60
Solenoids: General Purpose and Explosion Proof
Services: Air, Water, Oil, Gas

STRAINERS AND FILTERS
Pipe Sizes: ⅛"—3"
Pressures: 250 P.S.I.; 450°F
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Special purpose solenoid valves and accessories are also stocked.

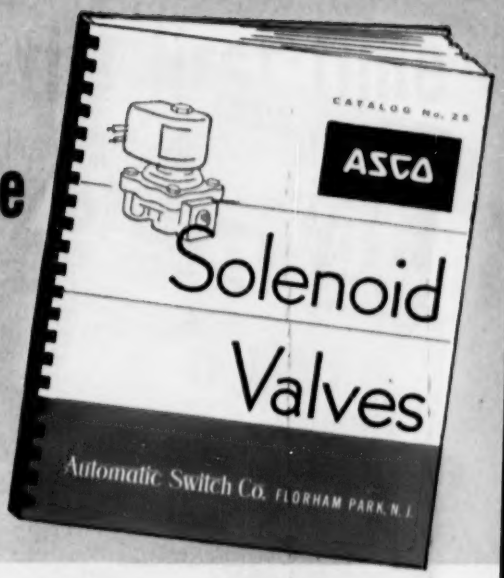
All sizes and types of ASCO Solenoid Valves now carried in stock by our warehouse in Los Angeles, and by stocking distributors in all principal cities.

Send for ASCO Solenoid Valve Stock List and Selection Guide.

ASCO

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ASCO makes Solenoid Valve selection simple

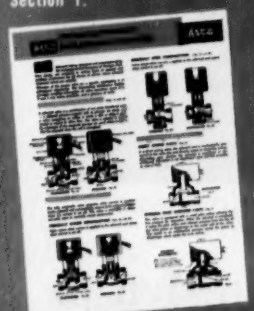


Comprehensive Design Engineering Data Now Available
Keys Proper Solenoid Valve to Application

Specifically designed to make the selection of solenoid valves simple, the ASCO Valve Catalog gives you the most comprehensive engineering data available to aid you in your solenoid valve selection.

Here are 114 pages of up-to-date valve information. These pages incorporate detailed engineering sections. Finding the proper valve for your particular application is made easy by a simple *master index* which leads you to a *separator* where you will find all the valves of the type you require. Each *separator* has a more detailed *index* which will enable you to turn right to the *valve bulletin* needed to meet your particular requirements.

Section 1.



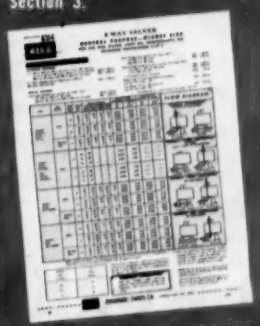
GENERAL ENGINEERING INFORMATION
Expanded engineering data with diagrams, gives valve construction, operating principles, features. With nomographs using Cv ratings for valve sizing.

Section 2.



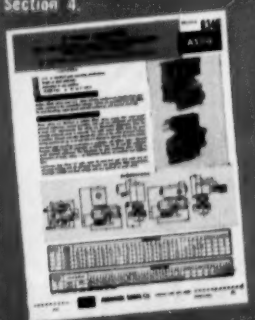
2-WAY VALVES
Covers all 2-way valves of the fully automatic type for a wide range of pipe sizes and pressures.

Section 3.



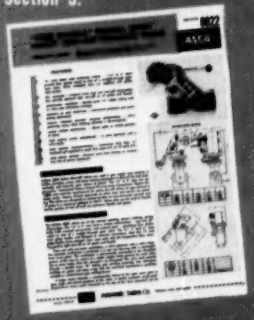
3-WAY VALVES
Detailed information on fully automatic valves for pilot control of diaphragms or cylinders, or for diverting flow in pipelines.

Section 4.



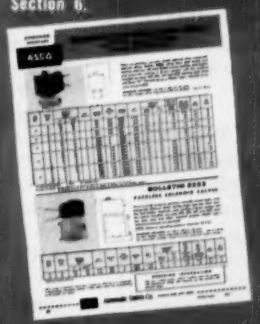
4-WAY VALVES
Fully automatic types covered. Both single and dual solenoid construction for general purpose and J. I. C. requirements.

Section 5.



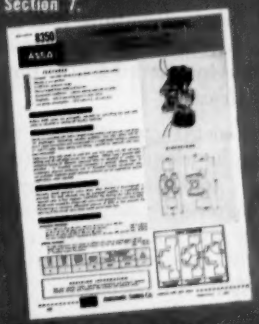
MANUAL RESET VALVES
2 and 3-way solenoid valves for safety shut-off applications.

Section 6.



CORROSION RESISTANT VALVES
Includes 2 and 3-way solenoid valves for handling corrosive gases and liquids. Section incorporates a selection guide chart.

Section 7.



SPECIAL PURPOSE VALVES AND ACCESSORIES
Special purpose equipment, waterproof and explosion proof solenoids, laundry valves, cylinders, etc.

Section 8.



NUCLEAR VALVE DATA
Shows ASCO specialized solenoid valve designs for nuclear, guided missile, Navy and dispensing applications.

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ASCO



5164-GS-B
164-pc tool set
$34.45 down
only $7.07 a week

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PACKAGED WORKSHOP

puts the right tool at the mechanic's finger tips

Rush your repair jobs and break downtime bottlenecks with this basic kit of *Snap-on* tools. Mechanics like its space-saving compactness. You'll like its timesaving completeness that puts the right tools on the job with the repair crew.

The 164 tools in the all-metal carrying case are basic for everyday operation . . . will handle hundreds of shop and field maintenance jobs. It's an excellent selection for on-the-job servicing of diesel or gasoline engines, material handling equipment, cars and trucks, plant utilities, factory machinery. Socket sizes range from 3/16″ to 1-1/4″ in 1/4″, 3/8″ and 1/2″ square drives. Boxockets 5/16″ to 1-1/4″, open ends 7/32″ to 1″.

Make sure the mechanics in your shop see this advertisement. Many other compact, timesaving *Snap-on* kits and tools are also available. Your *Snap-on* man can give you specialized tool service and recommend the best tools for your needs. Write us or call your nearest *Snap-on* branch.

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PEOPLE . . .

NAMES IN



Warren L. McCabe

Men of

Two men in the field of education earn the AIChE's Tyler Award recognition for chemical engineering literature.

The American Institute of Chemical Engineers has hailed two educators for outstanding contributions to chemical engineering literature.

Top honors went to Warren L. McCabe—administrative dean of Brooklyn Poly—who won the Tyler Award, given annually by the New York section of the AIChE. McCabe was honored for his new book, "Unit Operations of Chemical Engineering," (McGraw-Hill Book Co., 1956).

Elmer Gaden, associate professor of chemical engineering at Columbia University, earned an honorable mention for his extensive report, "Foams in Chemical Technology," (*Chemical Engineering, October* 1956, p. 173) and "Chemical Technology of Fermentation," (*Chemical Engineering, April* 1956, p. 159).

▶ **The Prize Winner**—McCabe's

THE NEWS

M. A. GIBBONS



Elmer Gaden

the Month

book (which he authored along with Cornell's Julian C. Smith) is a beginning text for junior and senior undergraduates. It treats each of the unit operations separately—from a practical as well as a theoretical standpoint.

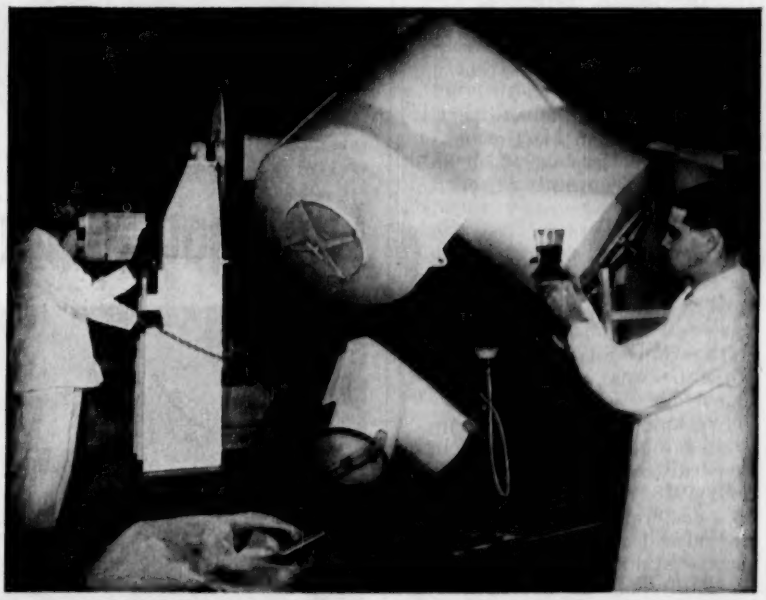
Its approach to fluid flow, however, differs from conventional treatments. In this book, the subject matter has been completely rearranged, incorporated with a great deal of new material and dubbed "fluid mechanics."

It took some four years to do the job: to glean information from the best of McCabe's classroom notes, to integrate the wealth of new material into the old subject matter and to whip the whole into the present final product of publishing caliber.

Though the book is out now and in the classroom, McCabe hasn't found time hanging heavily on his hands. Now that spare moments are no longer crammed with proofreading and rewriting chores, McCabe may take on a

Now! For the first time

intimately blend any liquid, regardless of viscosity, into dry solids — in one fast step — even up to 40% liquid volume by weight





VERSATILE. This wire cage assembly gives you three blenders in one. With it you can blend liquids into solids, or obtain dry intensive mixing action. Remove it and get gentle blending.



TYPICAL EXAMPLE. Bar breaks down agglomerates in material at left and prevents new agglomeration as liquid is added. Note uniform consistency in finished blend at right.



ABSOLUTE UNIFORMITY. Laboratory smear test reveals streaks where standard blending methods are used (left). With P-K's exclusive design, complete blending is assured (right).

These results can be proved in your own lab with a P-K Laboratory Model Liquid-Solids* Blender. 8 to 16 qt. capacity available from stock for instant delivery. Scale-ups from lab tests are equalled or bettered in P-K production models with capacities from 1 to 50 cubic feet. This is a completely new concept in liquid-solids blending—exclusive with P-K.

Patterson Kelley

Chemical and Process Division

*Patents Pending

See next two pages for more details

few consulting assignments and perhaps even drive to Canada for a few days of needed vacation.

But that's just for the summer. Once school starts again later this month, his post as administrative dean will take care of the better chunk of his weekday hours—and some of those on the weekend too.

No complaints about that, though—not when his time-eating job is in the field which he has always preferred above all others.

▶ **Looking Back**—McCabe began his career in education at MIT in 1923—the year he earned a master's in chemical engineering at the University of Michigan. While he was teaching at the Cambridge school, Worcester Polytechnic Institute also appointed him special lecturer in chemical engineering.

By 1928, McCabe had chalked up a doctorate. At that time, he was already a member of the faculty at his own alma mater in Michigan. He joined Carnegie Tech's staff in 1936 and became head of the chemical engineering department the following year.

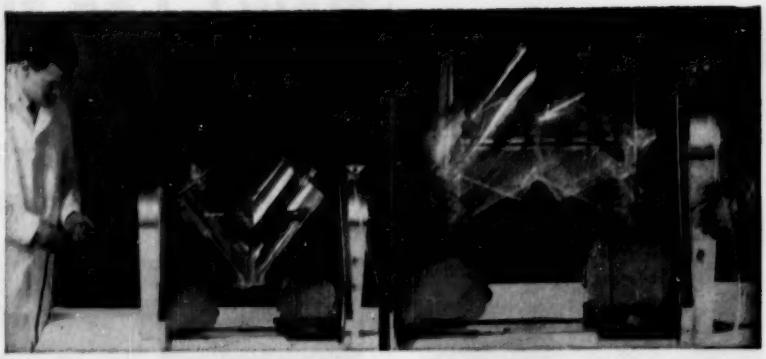
Then, after a ten-year stint in Pittsburgh, he became director of research of the Flintkote Co., in Whippany, N. J. Not long after, he served as vice president of the firm and held that post until he took over his present duties at Brooklyn Poly in 1953.

Besides his tough schedule as dean, McCabe has been an active participant in various societies in his field. He's a past president of the American Institute of Chemical Engineers and of the Ass'n of Engineering Colleges for New York State. McCabe was also a member of the executive committee of the Engineers Council for Professional Development.

▶ **Biochemicals Expert**—In contrast to McCabe—who is enjoying the peak of his career—Elmer Gaden is just getting his underway.

A mighty healthy start it is, though, at that.

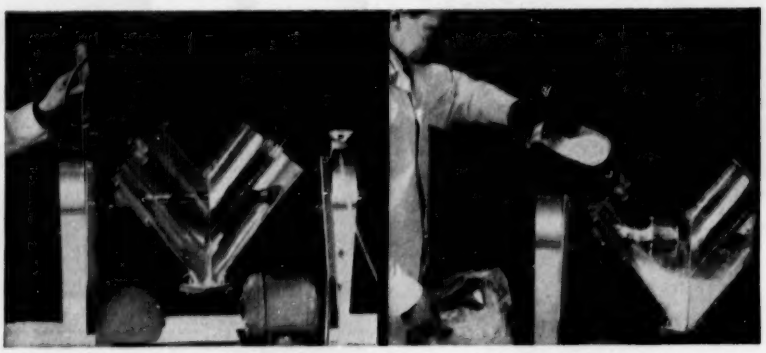
After earning his doctorate in chemical engineering at Co-



SIMPLY PLUG IN P-K liquid-solids lab blender to begin demonstration. 8 and 16-quart units use 115v, 60 cycles, ac, in standard outlet.

NOTE EASY OPERATION. Separate toggle switches provide individual control for both shell and liquid-feed bar rotation.

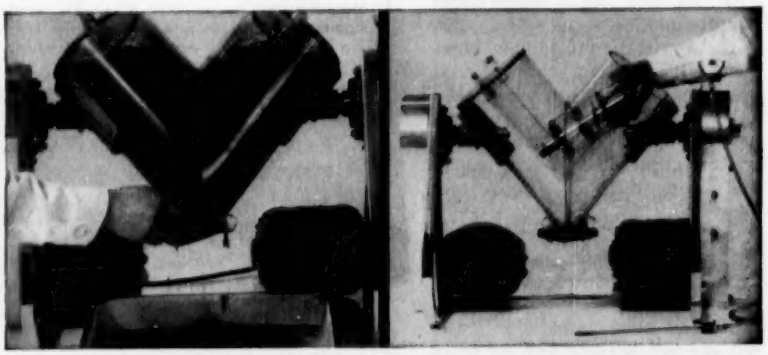
Lab model quickly shows how



EASY ACCESS TO EACH TWIN-SHELL by loosening two wing nuts to remove gasketed cover. Load dry solids through either opening.

LOAD DRY FORMULATION. p-k 8-quart lab blender can be charged to 70 lb. per cu. ft.; 16-quart unit to 80 lbs. per cu. ft.

why p-k liquid-solids blender

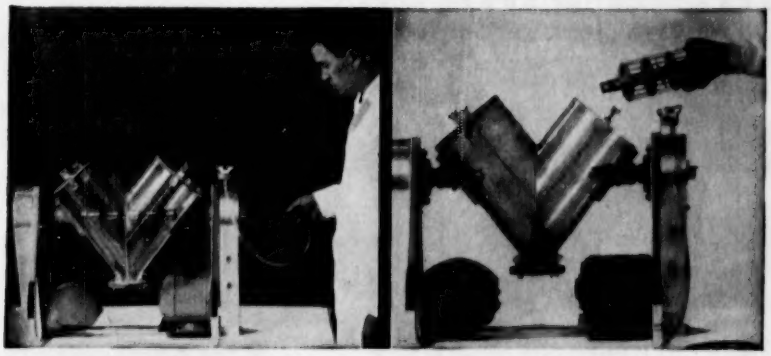


PERFECT DISPERSION IN BRIEF MINUTES p-k liquid-solids lab blenders discharge through apex of the twin-shells quickly, easily.

3-IN-1 BLENDER. Liquid-feed bar blends liquids into solids, is an intensifier in dry formulas. Remove cage for standard blending.

Patterson Kelley

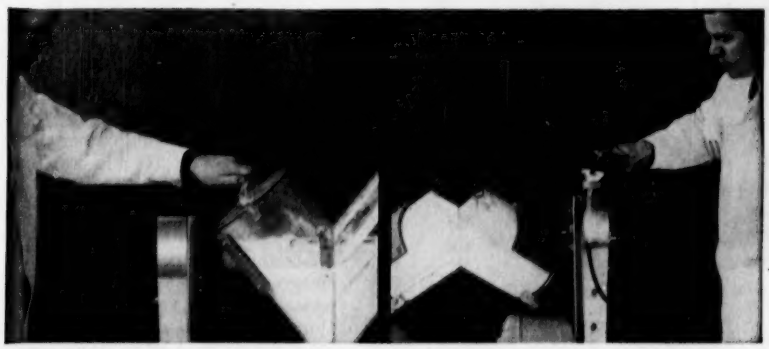
Chemical and Process Division



INSERT LIQUID FEED. Liquid-feed tube assembly takes mere seconds to insert, is available for any viscosity by pump or gravity feed.

UNIQUE LIQUID DISPERSER acts as intensifier bar; gives intimate dispersion, prevents agglomeration, speeds perfect blending.

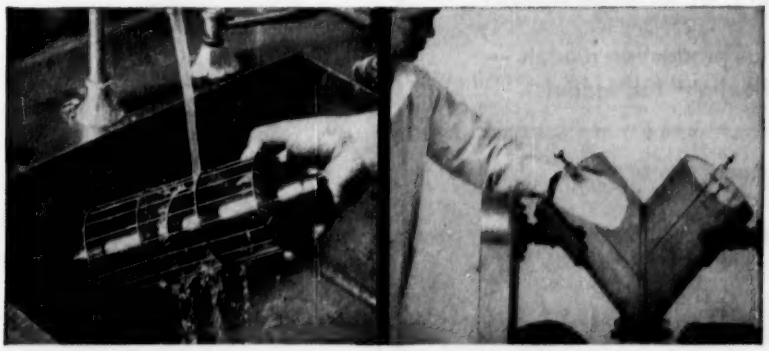
unique blending concept works



LOCK COVER WITH WING NUTS. Now start the twin-shells rotating and watch the gentle rolling, softly blending action.

INTRODUCE LIQUID by gravity or pump. Wire cage frees dispersal discs from clogging. Discs fling centrifugal spray into dry solids.

gives you perfect dispersion



CLEAN LIQUID-FEED IN SECONDS. Easily removed cage and liquid-feed bar speeds conclusion of fast, one-step blending test.

NO OBSTRUCTIONS IN TWIN-SHELL permit quick, thorough cleansing for new test or storage of unit.

SEE NEXT PAGE
FOR CATALOG OFFER

lumbia, in 1949, Gaden spent a year or so working for Chas. Pfizer & Co. There he had a chance to put to the test much of the work he had done in the preparation of his thesis on the engineering side of fermentation.

In 1951, Columbia convinced him to join the faculty as assistant professor. Today, he's still there—now, though, as associate professor. And, whenever he's not in the classroom, you'll probably find him somewhere in the laboratory working on newer and tougher fermentation problems.

▶ **Concentration**—This year, society activities will further his extensive contact with his specialized field. In December, he'll handle an AIChE session, in Chicago, designed to cultivate the interest of young engineers in biochemical processes.

Gaden's concentration explains the rather prolific amount of published material he has turned out on the subject during the last year or two. In addition to the two extensive reports which won for him the current recognition, this year he came up with another on "Biochemicals Processing" which appeared in the May 1957 issue of *Chemical Engineering*, page 237.

Elmer's enthusiasm for his field of specialization and for teaching is about as extensive as his enduring and concentrated efforts in both—and that's quite a bit.

Actually, he has been interested in biochemistry ever since his first youthful ambition for a specific career: He had originally wanted to go into medicine. And, his love of teaching will probably keep him for sometime right where he's been for the past six years—in the classroom.

James F. Haskett has been appointed general manager of Fischer & Porter Co.'s water and waste division.

O. H. Storey, Jr., has been named product manager for Flintkote Co.'s gypsum products, in Texas.

Lloyd Merwin, former vice president in charge of Texas

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NAMES . . .

operations for the Gaylord Container division, has been elected vice president of Crown Zellerbach Corp.



Edward E. Slowter

Newly elected vice president of Battelle Institute—Edward E. Slowter—has been the foundation's secretary and business manager.

As a commissioned officer during World War II, Slowter received the Army Commendation Ribbon for his contributions to the development of improved antiaircraft fire control procedures. Over the years, he has contributed to regional and national symposia and conferences on research and laboratory management.

Slowter graduated in chemical engineering from Ohio State University. He is a member of the AIChE.



John G. Kronseder

Former manager of chemical engineering for International Minerals & Chemical Corp., John Kronseder, is now assistant director of process development at Velsicol Chemical Corp., Chicago.

At IMC, Kronseder had managed a staff of engineers en-

gaged in engineering development, preliminary engineering and detailed design. He also acted as consultant for Corporation and operating division management on engineering matters.

Kronseder earned his B.S. in chemical engineering at Newark College of Engineering. He is a member of the AIChE, the ACS and the American Management Association.



Robert M. Hexter

Assistant Professor of Chemistry, Robert M. Hexter, of Cornell University, joined the Mellon Institute earlier this month.

In his new assignment, Hexter will work in fundamental research as a senior fellow.

Hexter was born in the South but was raised in Minneapolis and St. Paul, Minn. His studies at the University of Minnesota were interrupted for two years while he served with the Army's Chemical Corps. When he received his degree in 1948, he stayed on as a research assistant. Later, while doing graduate work at Columbia, he served as a graduate assistant and held a du Pont postgraduate fellowship.

In 1952, Hexter joined Cornell University's faculty as an instructor in chemistry. He became an assistant professor two years later.

Edgar B. Chiswell, former manager of process research and development for California Research Corp., has been appointed executive secretary of California Chemical Co., subsidiary of Standard Oil Co. of California.

Ralph L. Boyer has been elected vice president and director of engineering by Cooper-

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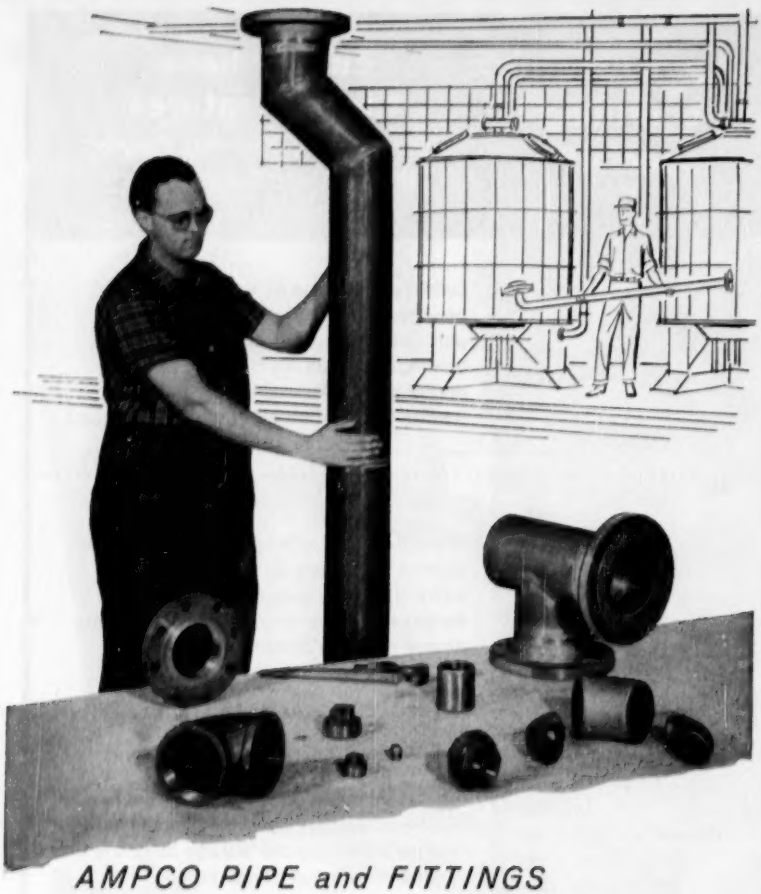
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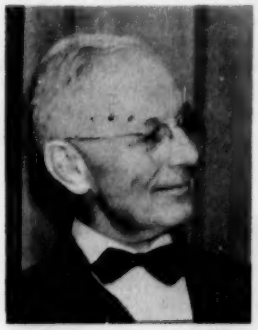

SHEET AND PLATE


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PR-26

NAMES . . .

Bessemer Corp., Mt. Vernon, Ohio.



Roy C. Newton

The American Institute of Chemists has presented its 1957 Gold Medal to Roy C. Newton—vice president at Swift & Co., Akron, Ohio.

Newton received the award for his many important contributions in the field of food technology.

The Award was given at the Institute's 34th annual meeting at the Sheraton Hotel in Akron.



Mathew M. Braidech

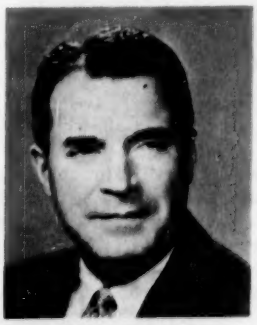
The 1957 Benjamin G. Lamme Medal has been presented to Mathew M. Braidech, research director, Fire Prevention and Engineering Standards Department of the National Board of Fire Underwriters.

Before joining the Board in 1945, Braidech was chief chemist for the department of public utilities, City of Cleveland, Ohio, and, later, a professor of industrial chemistry at Case Institute of Technology.

During World War II, he was principal chemical engineer consultant to the Office of the Rubber Director. Currently, he holds

a reserve commission as Colonel in the U. S. Public Health Service because of his interest in disaster control and emergency planning.

The Benjamin Lamme award is given annually to a graduate of one of Ohio State University's technical departments "for meritorious achievement in engineering of the technical arts."



W. H. Schuette

Newly elected member of the board of directors at Dow Chemical Co. is William H. Schuette. In 1955, he also took over duties as general manager of the Midland Division.

Schuette began his career with the firm in 1941 as a member of the chemical engineering laboratory. Soon he transferred to production of styrene monomer, Styrofoam and Styron.

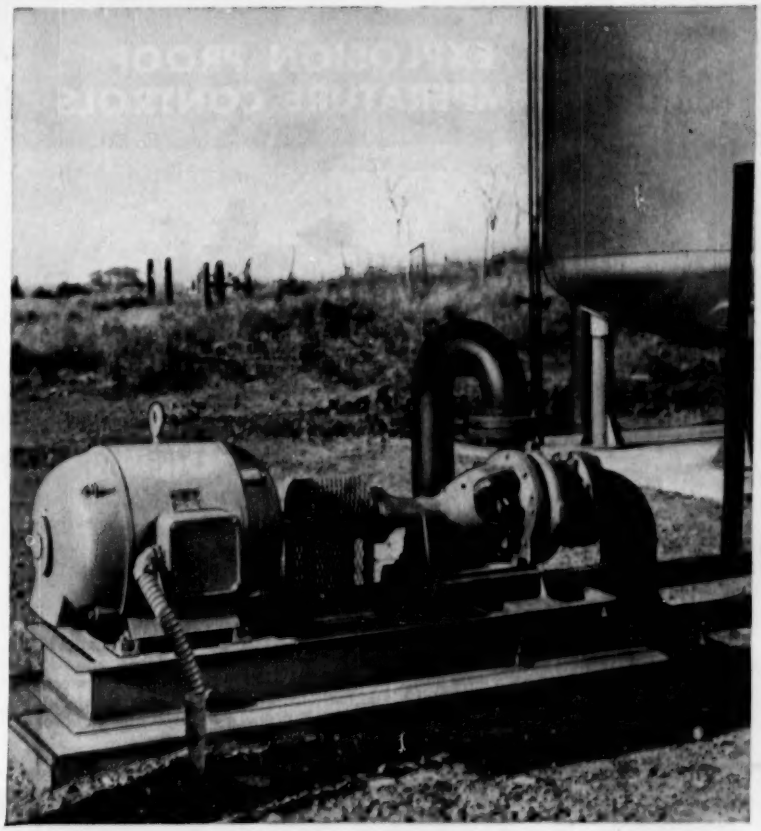
By 1952, he became plastics production manager. And, three years later, he was promoted to the post of assistant to the general manager.

A native of Cleveland, Schuette studied chemical engineering at Case Institute of Technology. By 1941, he had earned his Ph. D. in the field.

Before joining Dow, he served as an instructor at Case and was also associated with National Carbon Co. and the C. O. Bartlett and Snow Co.

Robert S. Savage and **Joseph R. Kelly Jr.** have been named special representatives of Goodyear Tire & Rubber's chemical division, in Akron, Ohio.

Henry L. Cox, specialist in food technology, has been appointed a technical consultant at Armour Research



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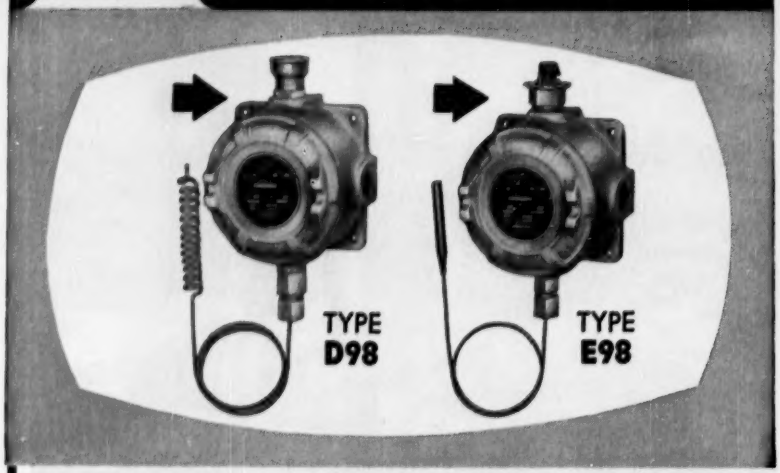
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Enclosure	Class I, group D and Class II, groups E, F and G explosion-proof enclosures; cast iron base, aluminum cover.
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NAMES . . .

Foundation of Illinois Institute of Technology.



J. M. Gaines

Linde Co., division of Union Carbide Corp., has appointed J. M. Gaines associate technical director.

Formerly, Gaines had been director of research for the company. New duties will include responsibility for technological developments in process metallurgy —especially of iron and steel— and in related fields.

Born in New Haven, Conn., Gaines studied in his hometown at Yale University. Later, he did graduate work at MIT.

Gaines began his career with the U. S. Bureau of Mines in 1926. He joined Linde in 1933 at the Buffalo Lab, and has remained with the firm ever since.



William B. Bowman

American Cyanamid's William B. Bowman has been elected honorary chairman of the American Section, Society of Chemical Industry, for the year 1957-1958.

Bowman is assistant general manager of the Cyanamid's organic chemicals division. He earned his chemical engineering degrees at the University of

Toronto and at Case Institute of Technology. Previous work experience includes the following associations: Shawinigan Chemicals, Ltd., Armstrong Cork Co., and Westvaco Chlorine Products Corp.

In 1945, he joined Jefferson Chemical Co. (subsidiary of American Cyanamid and The Texas Co.) as market development manager. Later, he became vice president in charge of operations.

In his new Society post, Bowman succeeds Monty Spaght, executive vice president of Shell Oil Co.



Bryce L. Rhodes

International Minerals & Chemical Corp. has named Bryce L. Rhodes as general manager of its phosphate chemicals division.

Rhodes who joined IMC in 1954 as development manager of the division, was named its development and production staff manager last year. Before joining the Chicago firm, he was a vice president of Synthron, Inc., Providence, R. I., textile chemical manufacturers.

After attending Northern Montana College and the University of Minnesota, Rhodes received a master's in chemical engineering from Cornell University in 1946.

He is a member of the AIChE and the ACS.

W. P. Morris has been elected president of Duval Sulphur & Potash Co. at Houston, Tex.

Cledo Brunetti has been appointed executive assistant to James Hait, executive vice

another installation of heat exchangers by National-U.S.

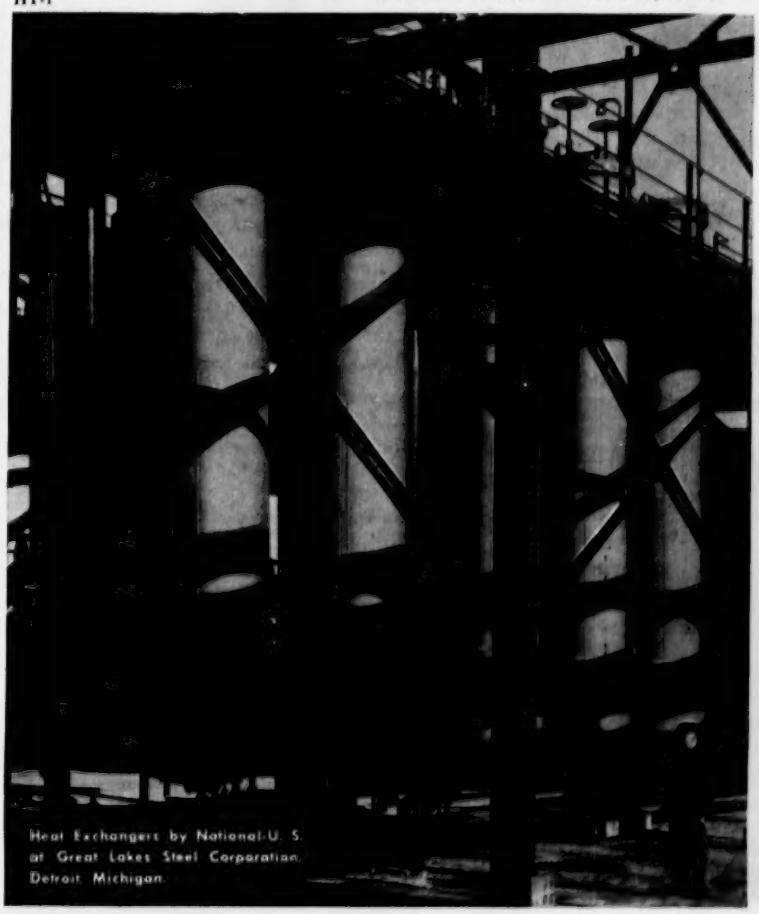
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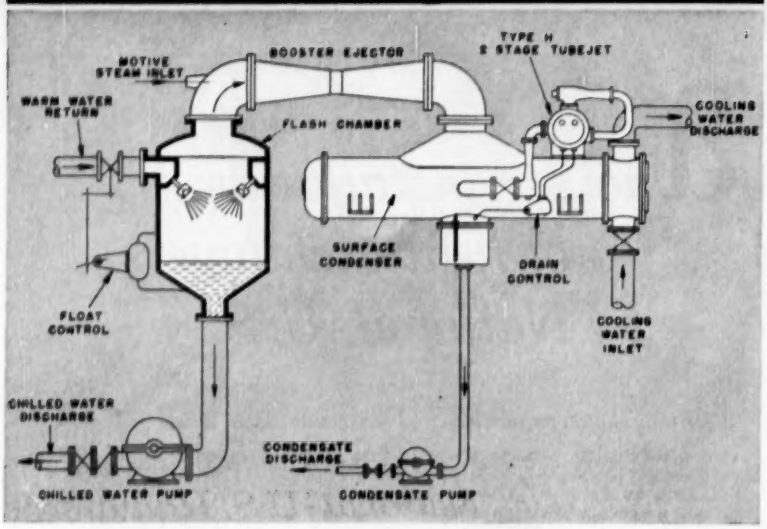
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HT-1



Heat Exchangers by National-U. S. at Great Lakes Steel Corporation, Detroit, Michigan.

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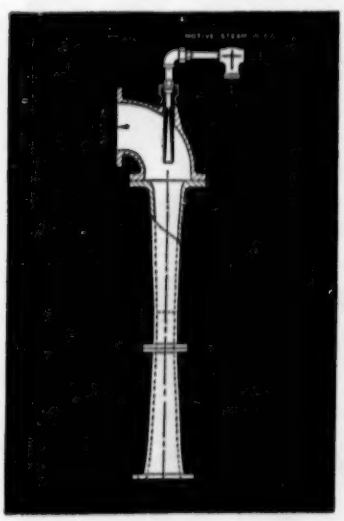
Above schematic diagram shows Wheeler Jet Vacuum Refrigeration Unit with surface condenser. Unit is easily adapted to low level jet or barometric jet condensers.

when you CHILL PROCESS WATER

C. H. Wheeler Steam Jet Vacuum Refrigeration operates at exceptionally low cost because it uses low pressure exhaust steam—steam that would otherwise be wasted in your processing plant.

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president of Food Machinery & Chemical Co.



T. Richard Probst

The Brown Co., Boston, Mass., has appointed T. Richard Probst as vice president in charge of operations.

Since 1954, Probst has been vice president and manager of mills of the eastern corporation in Bangor, Me. In his new post, he'll make headquarters in the Berlin, N. H., area.

Probst is a native of Loch Haven, Pa. He graduated from Pennsylvania State College in the class of 1935, with a B. S. degree in chemical engineering. Later, he earned an M. S. and his doctorate from the Institute of Paper Chemistry, in Appleton, Wis.

Before joining the Brown Co. in 1954, he was assistant general manager of Columbia River Paper Mills, Portland, Ore.

The American Petroleum Institute has awarded certificates of appreciation for meritorious service to: **Hugh J. Field,** vice president in charge of research and development, Atlantic Refining Co.; **J. B. Hill,** retired, Sun Oil Co.; and **Daniel P. Barnard,** research coordinator, Standard Oil Co. (Ind.), Chicago.

Richard B. Wessel has been appointed to the position of field research supervisor—East—for California Spray-Chemical Corp.

Osman J. Walker, head of the department of chemistry and director of the school of graduate studies, University of Alberta, has been elected

President of the Chemical Institute of Canada for 1957-1958.

Truman P. Kohman has been promoted to professor of chemical engineering at Carnegie Institute of Technology, Pittsburgh, Pa. Kohman supervised the research which led to the discovery of Aluminum 26 — radioactive isotope.

Kenneth A. Spencer, founder and president of the Spencer Chemical Co., has won the 1957 Memorial Award of the Chemical Market Research Ass'n.

E. M. Kipp has joined Foote Mineral Co. as director of research. He'll handle the research and development department at Berwyn, Pa.

Kenneth Merle Watson, former vice president of Pure Oil Co. has joined the staff of Illinois Institute of Technology, Chicago.

John J. Craig, former senior associate editor of Chemical Week magazine, and more recently an executive with G. M. Brasford Co., has joined W. Alec Jordan Associates as vice president.



Hal B. Coats

As a part of the reorganization and expansion of its Midwest headquarters in Chicago, the chemical plants division of Blaw-Knox Co., Pittsburgh, has appointed Hal B. Coats assistant manager.

A veteran of fifteen years with Blaw-Knox, Coats has served as research and development direc-

sealing against 95% H_2SO_4
at 70°C. to 90°C. for 15,000 hours
continuous service at 1750 R.P.M.

..a Chemiseal's record at Kolker Chemical Co.



This Chemiseal All-Teflon Mechanical Seal —first of four installed at this plant and all serving with equal satisfaction—was the third type of mechanical seal to be tried for the application, after other makes had quickly failed.

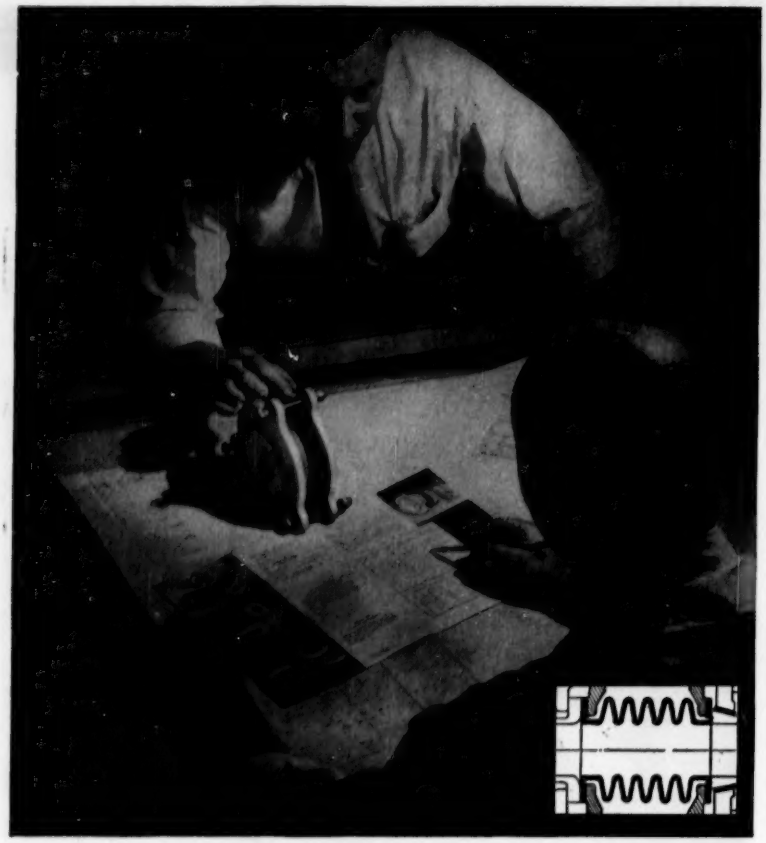
The user's comment is, "No praise is too high for this seal."

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tor of the division and manager of its atomic energy department.

Coats holds chemical engineering degrees as well as a doctorate from the University of Michigan. He's a registered professional engineer in Pennsylvania and Michigan and a member of the AIChE, ACS, Phi Lambda Upsilon, Iota Alpha and Sigma Xi.

Before joining Blaw-Knox, Coats was a chemical engineer for the Upjohn Co. in pharmaceutical production, laboratory director for Leslie Laboratories, research fellow for the Natural Gasoline Ass'n and a research chemist for the Atlantic Refining Co.

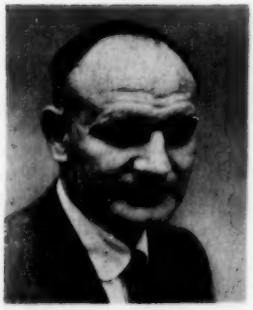
E. J. Corell and **M. W. Jones** have formed a partnership to do engineering and consulting work in the heavy chemical and power fields. Both men were formerly with Columbia-Southern Chemical Co. at the Barberton, Ohio, plant. Their new office is in Akron, Ohio.

Charles Aust has been promoted to the newly-created post of technical director of Goshen Rubber Co., Inc., Goshen, Ind. **Louis Rhodes** will succeed Aust as chief chemist.

R. E. Workman, manager of Goodyear International's chemical division, has been chosen for a Sloan Fellowship for participation in the executive development program at MIT, in Cambridge, Mass.

Grant E. Russell has been appointed manager of the systems section of the engineering department of Monsanto Chemical Co.'s research and engineering division, in St. Louis, Mo.

Harry B. Warner has been named recipient of the "Outstanding Alumnus Award" presented by Texnikoi, a College of Engineering organization at Ohio State University. Warner is vice president-development of B. F. Goodrich Co.



Walter N. Alexander

In a move to broaden the administrative staff to cope with the expanding volume of its chemical process and plant business throughout the world, Scientific Design Co., Inc., has promoted Walter N. Alexander to the position of senior vice pre[illegible]t.

[illegible]ider will coordinate engineering, construction, and operating activities in his new post.

Formerly, Alexander had been director of operational planning and chief design engineer at Linden, N. J., for General Aniline and Film Corp. (dyestuff & chemical division).

Most recently, he has been functioning as executive vice president of SD Plants, Inc., construction subsidiary of SD—a position he'll continue to hold.

Alexander is a graduate of Yale with a degree in chemical engineering.

Modesto L. Leonardi has been named manager of plant production at American Potash & Chemical Corp's main plant at Trona, Calif.

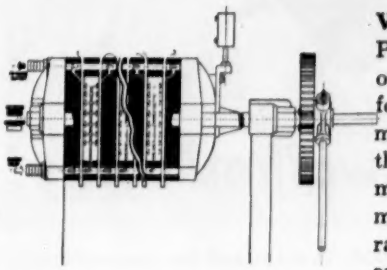
Sidney Katz has been promoted to scientific advisor at Armour Research Foundation of Illinois Institute of Technology, Chicago. He is a member of the Foundation's chemistry and chemical engineering department.

G. R. Hauer has been named to head up activities of Infilco Inc.'s new industrial water and waste treatment department, in Los Angeles, Calif.

Arthur W. Carpenter, former manager of the physical test-

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NAMES . . .

ing labs of B. F. Goodrich, has been chosen to receive the Charles Goodyear medal for outstanding contributions to rubber science and technology.



Jerome Wilkenfeld

Hooker Electrochemical's Jerome Wilkenfeld has been appointed by Governor Averell Harriman as industry's representative on the newly created New York State Air Pollution Control Board.

Advisor on air and water pollution abatement problems for all Hooker plants, Wilkenfeld is Hooker's assistant technical superintendent, at the Niagara Falls plant.

Wilkenfeld graduated in chemical engineering from City College in 1943, and joined the firm's operating department immediately after graduation.

Over the years, he has been active on air pollution abatement committees of such organizations as the Manufacturing Chemists' Ass'n, the Michigan Manufacturers Ass'n, and Associated Industries of New York State.

H. G. Boynton, E. W. Lewis, and **J. R. Miller** have been promoted to senior research chemical engineers in the research and development division at Humble Oil & Refining's Baytown, Tex., refinery.

R. U. Blaser, assistant superintendent, materials division, Babcock & Wilcox Co., and **J. J. Owens,** former employee of Babcock & Wilcox, have been presented with the 27th Charles B. Dudley Medal of

the American Society for Testing Materials for their paper on "Special Corrosion Study of Carbon and Low-Alloy Steels."

Howard M. Christman, vice president and technical director of Massillon Refractories Co., Massillon, Ohio, has received the Trinks Award, for pioneering developments in refractory brick for furnaces.

R. I. Hoaglin, A. E. Montagna and **H. W. Schultz** have been appointed associate directors of the development department at Union Carbide Chemicals Co., in So. Charleston, W. Va.

Don C. Atkins, Jr. has joined U. S. Chemical Milling Corp. as assistant chief engineer in the firm's Manhattan Beach, Calif., plant. He had been director of reasearch and development for the chemical milling division of Turco Products, Inc.

Robert M. Magness has been named assistant to the manager of heavy chemical sales for U. S. Industrial Chemicals Co., division of Nat'l Distillers & Chemical Corp., in New York.

Donald G. Brower is now manager of research for Victor Chemical Works in Chicago. Brower has been in the firm's employ for about 25 years.

Jay B. Ford, Jr., is now assistant general manager of the Pacific Coast Borax Co. division of U. S. Borax & Chemical Corp., New York. Formerly, Ford was with the U.S. Potash Co. division.

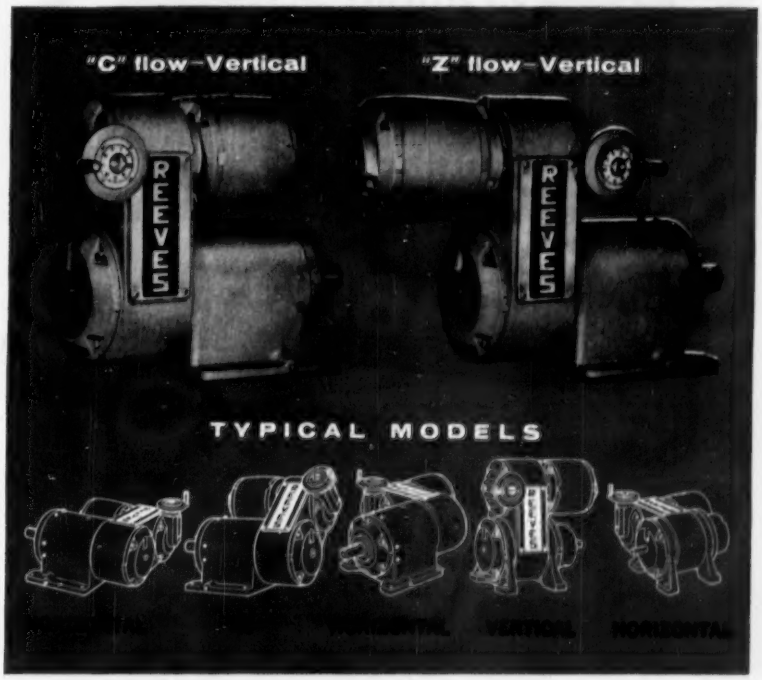
Charles E. Webber, Sun Oil Co. vice president in charge of production, has been given the Hanlon Award Citation at the 36th annual convention of the Natural Gasoline Ass'n of America.

W. L. Nelson has received this year's award of merit given by the American Ass'n of Cost Engineers for his many

NEW **REEVES**®

*Sizes 200-300 Vari-Speed MOTODRIVES**

*200-300 Size, 1 through 5 hp.; full line, ¼ through 40 hp.





The flexible design of these compact new REEVES variable speed power packages permits hundreds of combinations . . . space-saving, space-fitting *standard* assemblies to meet most installation requirements. All models are available in both "C" flow and "Z" flow styles.

New increased capacity is built in the reducers—single, double or triple stages . . . new disc assemblies permit wider output speed ranges . . . discs are pre-aligned . . . pre-loaded spring maintains correct belt tension for longer belt wear . . . *exclusive* "close-grooving" lubrication assures free sliding discs . . . new Metermatic system automatically lubricates the motor and variable shaft bearings.

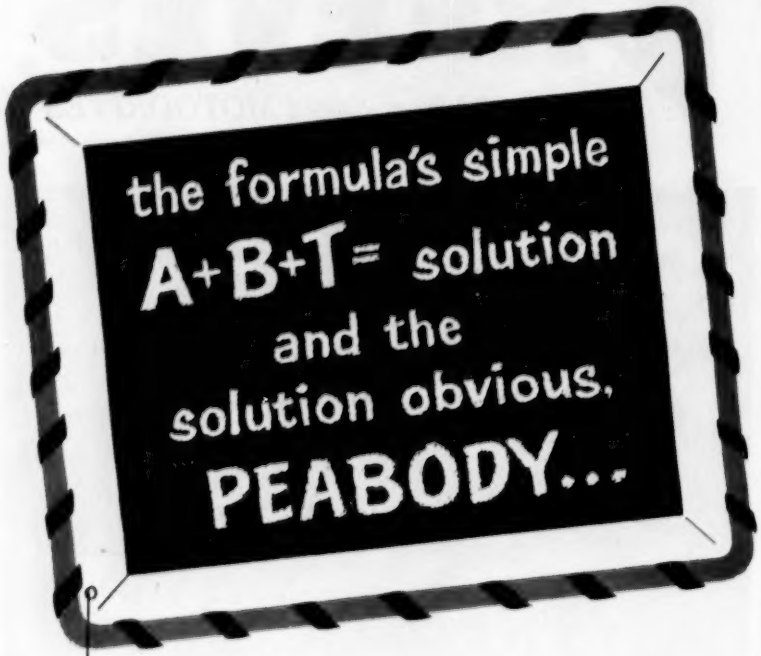
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Division of **RELIANCE** ELECTRIC AND ENGINEERING CO.

Columbus, Indiana

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• here's why-

A = Air. Many process problems involving air heating require huge amounts of air. Peabody Air Heaters can – and do – handle over 250,000 SCFM. They are job engineered to your specifications for up, down, or horizontal firing!

B = BTU. These same process problems require high heat release and Peabody units offer you as much as 350,000,000 BTU/hr. in a single prefabricated furnace using a single burner.

T = Temp. Temperature sometimes has to soar – and Peabody Air Heaters offer temperatures ranging up to 2,500° F.

If you need a compact, cylindrical, air heating furnace, pressurized or unpressurized, to deliver a controlled volume of heated air, look to Peabody, the standard of efficiency throughout the world.

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7-054

NAMES . . .

publications in the field of cost engineering.

Marshall Sittig, president and managing director of the American Lithium Institute, Inc., has been appointed chairman of a symposium on alkali metals to be held at the ACS national meeting in San Francisco next April.

David Lange of Caltech and Fred Wolf of Pomona College have been selected to study under a program of summer research, set up by Don Baxter, Inc., research and production labs.

Lambert J. Wischerath has retired from his vice presidential post with Blaw-Knox Co.'s Buflovak Equipment division after 35 years service with the firm.

Robert G. Schmidt, a chemical engineer, has been named project manager for the new $4 million plant of Callery Chemical Co., Lawrence, Kans.

Chester H. Goodwin has been appointed project manager for Chemstrand Ltd.'s new Acrilan acrylic fiber plant, now under construction in Coleraine, Northern Ireland.

James A. Malloch of Western Phosphates has been promoted from maintenance superintendent to plant engineer; Frank W. Bless is now production superintendent.

Walter O. Simon has been appointed assistant general manager of Du Pont's film department, in Wilmington, Del. He succeeds Arlington Kunsman who retired this summer after 41 years with the firm.

William J. McCudden has been named manager of lumber research and products development of Diamond Match Co.'s western lumber operations, Chico, Calif.

The American Petroleum Institute has awarded certificates of appreciation for contribu-

tions to petroleum technology to: **Hugh Field,** Atlantic Refining Co.; **J. R. Hill,** (retired) Sun Oil Co.; and **Daniel Barnard,** Standard Oil Co., (Ind.).

OBITUARIES



Vasili I. Komarewsky

One of the nation's foremost developers of synthetic fuels and a professor of chemical engineering at Illinois Institute of Technology—Vasili I. Komarewsky—died June 21.

Komarewsky founded the first university laboratory, in this country, to be devoted exclusively to the teaching of catalytic phenomena at Illinois Institute of Technology in 1936.

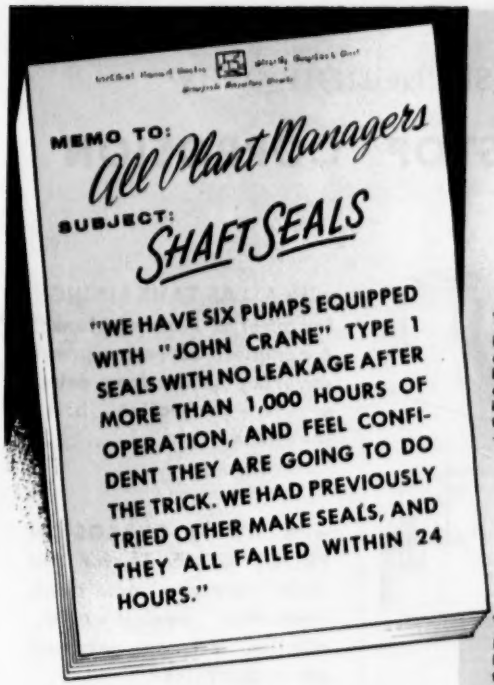
He became professor of chemical engineering in 1936 at Armour Institute of Technology, after serving as part-time lecturer at Northwestern.

Born in Moscow, in 1895, Komarewsky studied at the University of Moscow and did postdoctoral work at the Kaiser Wilhelm Institute in Berlin.

Komarewsky authored a large number of books and magazine articles on the subject of catalysis. He was also quite active as a lecturer before university and industrial groups.

Marvin O. Spielman, 51, director of research evaluations at Abbott Laboratories, died July 11 after a heart attack.

Robin G. Swain, 54, western district manager for St. Regis Paper Co., died of a heart attack on his cabin cruiser in San Francisco Bay, June 23.



This is part of an actual memo sent by one plant manager to others of the same company in different sections of the country—and that company is now exclusively specifying these and other type "John Crane" Shaft Seals for *all* their liquid handling requirements.

You too can save time, trouble and expense by doing likewise.

You'll find a "John Crane" Shaft Seal for every service . . . from hot or cold water to the most destructive acids and corrosives . . . high temperatures, high pressures . . . in types and sizes to meet practically any mechanical or dimensional requirement.

Send us details on your application. We'll recommend the proper shaft seal. Request Bulletin S-204-3 for complete overall information.

Crane Packing Co., 6451 Oakton St., Morton Grove, Illinois, (Chicago Suburb).

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

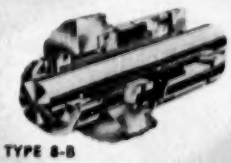
John Crane



TYPE 1
Designed for limited stuffing box diameter. Handles water, light hydrocarbons, refrigerants, mild acids and other liquids non-injurious to synthetic rubber at temperatures from −40°F. to +212°F., pressures to 200 psi.



TYPE 2
Designed for limited stuffing box length. Handles same services, temperatures and pressures as Type 1.



TYPE 8-B
Heavy duty, high pressures. Packaged construction for easy installation. Handles pressures to 1200 psi., temperatures from −40°F. to +250°F. Services same as Type 1.

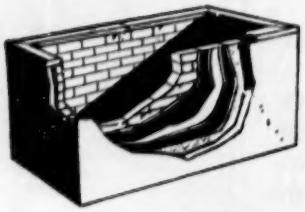


TYPE 9
Famous as a problem solver. Sealing members of chemically inert Du Pont Teflon. Engineered to service conditions to handle practically all destructive acids, corrosives and gases at temperatures from −120°F. to +500°F., pressures to 150 psi. Available in balanced construction for pressures to 750 psi.

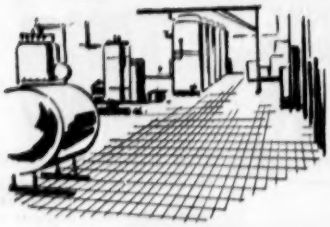




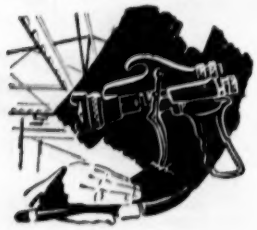
the most enduring way to ... STOP CORROSION



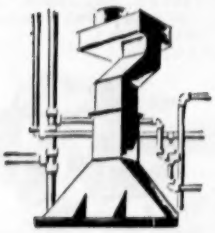
with ATLAS TANK LININGS for steel or concrete tanks. A complete corrosion-proof covering system from primer to protective brick sheathing.



with ATLAS CORROSION PROOF CEMENTS for the most severe conditions. Protection against acids, alkalies, salts, solvents and other corrosives.



with ATLAS PROTECTIVE COATINGS for almost every purpose. A complete line to assure the proper protective coating for the job.



with ATLAS RIGID PLASTIC STRUCTURES for tanks, fume exhaust duct work and complete pipe systems. Fabricated of highest quality corrosion proof plastics.

Specify ATLAS

Tear out this ad and check the block where corrosion protection is most needed in your plant. You will receive a complete bulletin giving all technical information.

- ☐ CEMENTS
- ☐ LININGS
- ☐ PROTECTIVE COATINGS
- ☐ RIGID PLASTIC STRUCTURES

ATLAS MINERAL PRODUCTS COMPANY
MERTZTOWN, PENNSYLVANIA

TECHNICAL REPRESENTATIVES THROUGHOUT THE UNITED STATES

PEOPLE . . . FIRMS IN

NEW LINES

Permacel Tape Corp. is now formulating and marketing its own line of epoxy resins under the Permacel trade name.

Pittsburgh Plate Glass Co. has begun full production of its Spandrelite heat-strengthened glass building panels.

National Vulcanized Fibre Co. announced a new grade of Nylon, National Nylon Grade 31, featuring improved electrical properties.

Borg-Warner Corp. has added a line of control-rod drive mechanisms to its products for the atomic energy industry.

NEW REPRESENTATIVES

Isocyanate Products is the sole sales and service representative for polyurethane foam machinery manufactured by Newton Tool & Mfg. Co., Wenonah, N. J.

NEW NAMES

Everpure, Inc., is the new name of Tested Appliance Co., Chicago, maker of Everpure water purifiers and Everclor automatic chlorinators.

NEW LOCATIONS

Fischer & Porter Co. has relocated its Houston, Tex., branch at 3783 Richmond Ave.

J. B. Roerig & Co., division of Chas. Pfizer & Co., has moved its home office to 800 Second Ave., corner 42 St., New York, N. Y.

E. V. Roberts & Associates, Pacific coast distributor for Shell Chemical's epoxy resins, has moved its northern

THE NEWS

J. B. BACON

California offices to 1560 Laurel St., San Carlos, Calif.

NEW FACILITIES

Union Carbide Corp. will build a $28-million ethylene glycol plant in Puerto Rico.

Stauffer Chemical Co. has just brought on stream new facilities at Louisville, Ky., to produce chloroform, methylene chloride, additional quantities of carbon tet and hydrogen chloride.

American Forest Products Corp.'s new $2.5-million paper mill at Newark, Calif., is now in production, will turn out over 50 tons/day of paper.

Formica Corp. has completed a $1.5-million addition to its Formica resin plant at Evendale, Ohio. New addition will allow for future production increases.

Commercial Solvents Corp. is opening a mid-Atlantic office with headquarters in Newark, N. J.

Utah Oil Refining Co. will build a $2-million, 35,000-bbl./day crude unit at Salt Lake City, Utah. Fluor Corp. will engineer and build.

Geon Co., Japanese chemical firm, will build an 8,500-ton/yr. synthetic rubber plant in Kawasaki near Tokyo. Plant will be completed by the end of 1958.

Clark Bros., a division of Dresser Industries, has opened new office and warehouse facilities in New Orleans, La.

Aluminum Co. of Canada has awarded to Beckman Instruments a contract to build a data-processing system for

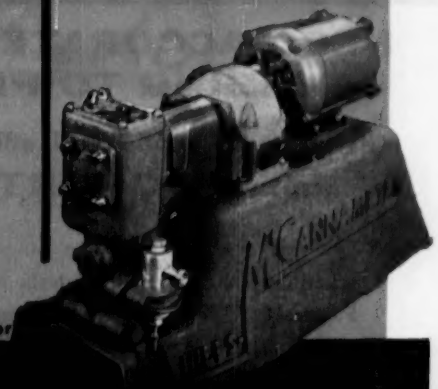
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PROVIDES PRECISION METERING AND PROPORTIONING OF FLUIDS

Versatile . . .
NEW high pressure range
NEW broad capacity range
NEW wide operating speed range

Cuts maintenance costs to a nub
NEW Teflon-faced diaphragm*
NEW packless design
NEW capsulated construction
NEW liquid end free of frictional parts
NEW lifelong lubrication

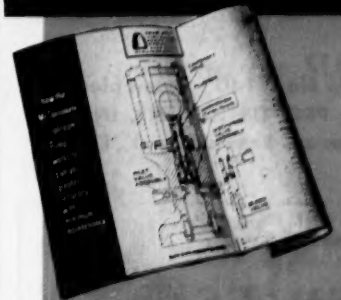
Accurate . . .
NEW precision for small quantities
NEW stepless stroke control



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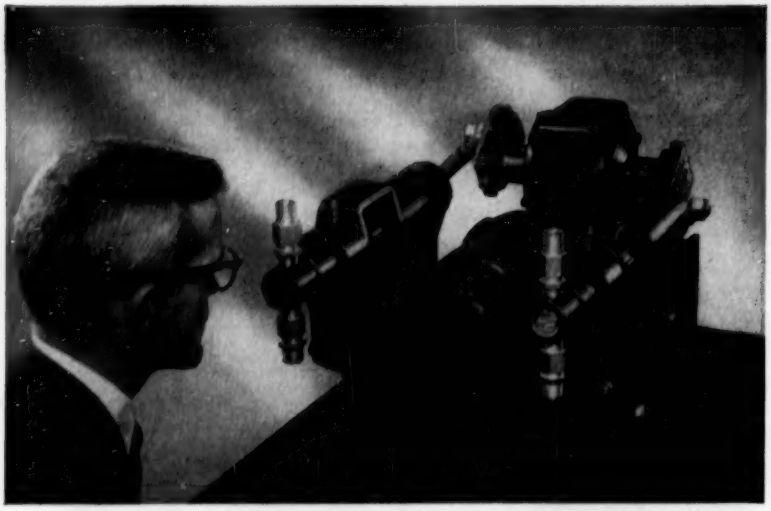
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Schematic drawing and full description shows you how the new McCannameter Diaphragm Pump works to deliver optimum performance in accuracy, versatility with low maintenance. Write for "A New Concept in Precision Metering and Proportioning of Fluids", booklet #30L.

Hills-McCanna Company 2341 West Nelson Street, Chicago 18, Illinois



NEED ACCURATE CHEMICAL FEEDING TO PROCESS?

Check into this economical, efficient, proportioning pump by PROPORTIONEERS!

For greater accuracy, greater range . . . feed all chemicals (alkaline, neutral, or acid) with the Model 1140 Proportioneer. Pay less, get more . . . interchangeable measuring cylinders, super-accurate Vane-Guide check valves, percentage calibrated stroke-length scale, etc.

- **Accuracy—within ±1%**
- **Capacities—from 0.8 GPH to 900 GPH**
- **Adjustment range—15 to 1**
- **For discharge pressures up to 1340 psig**

MODEL 1140 PROPORTIONEER					
Discharge Pressures up to	MAXIMUM CAPACITY PER CYLINDER IN GPH* (Minimum feed rate 1/15th of max. cap. by stroke length adjustment)				
1340 psig.	10.7	13.3	17.8	21.3	26.6
670 psig.	20.9	26.1	34.8	41.8	52.2
335 psig.	42.7	53.3	71.1	85.3	106.5
168 psig.	83.6	104.4	139.2	167.1	209.0
84 psig.	171.0	213.0	284.5	342.0	426.0

*Five operating speeds available for various fluid viscosities. For capacities of DUPLEX MODELS (see photo), double the capacities shown in table. If you need capacities and pressures other than these, consult Proportioneers, Inc., manufacturer of the most complete line of proportioning pumps.

Free Bulletin **Request Bulletin No. 1140 for complete data. Write to PROPORTIONEERS, INC., 369 Harris Avenue, Providence 1, R. I.**

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DIVISION OF
B-I-F INDUSTRIES
PROVIDENCE, RHODE ISLAND
BIF METERS FEEDERS CONTROLS

FIRMS . . .

monitoring cryolite recovery processes at Alcan's Kitimat, B. C., plant.

Du Pont's new 15-million-lb./yr. Hypalon synthetic rubber plant at Beaumont, Tex., is now in production. Hypalon is chlorosulfonated polyethylene.

Du Pont is boosting capacity by 50% at its Mylar polyester film plant at Circleville, Ohio. New facilities will be ready in early 1958.

Atomics International will build a 50-kw. research reactor for the Centro Di Studi Nucleari Enrico Fermi at the Politecnico of Milan, Italy. Reactor will be completed next year.

Foster Grant Co., Leominster, Mass., next month will bring into production its new Nylon-6 plant at Manchester, N. H.

Dow Corning has opened its new $250,000 silicone rubber fabrication laboratory at Midland, Mich.

British American Oil Co.'s new $4-million cat reformer is now on stream at its Clarkson, Ont., refinery. Reformer is processing 10,000 bbl./day of high-octane reformate.

Air Reduction Sales Co. has started construction of its $9-million air separation plant in Acton, Mass. Plant is scheduled for completion in the summer of 1958.

Platte Chemical Co. of Salt Lake City, Utah, plans a $2.5-million, 225-ton/day sulfuric acid plant at Casper, Wyo.

Davison Chemical Co. will build a $2-million, 200-ton/day sulfuric acid plant at Casper, Wyo.

Gewerkschaft Brunhilde, Hanover mining firm, will build West Germany's first uranium ore dressing plant to process 5,000 tons/yr. of uranium ore. Reported cost: $120,000. Ore will be sent for further proc-

essing to German or U. S. firms. Later, plant will be expanded to process more than 20,000 tons/yr.

Allied Chemical & Dye Corp.'s Solvay Process Div. will double capacity of its Moundsville, W. Va., vinyl chloride plant.

Canadian Industries Ltd. will double capacity of its polyethylene plant at Edmonton, Alta. Projected capacity: 40 million lb./yr.

Standard Oil Co. (Ind.) will boost capacity of its Wood River, Ill., refinery by about 30%. A crude distillation unit and a fluid cat cracker will be finished early in 1959.

Premier Oil Refining Co. has added a Platformer, Unifiner and other facilities at its Longview, Tex., refinery. Cost: about $1.5 million.

Ever-Tite Coupling Co. has opened a midwest sales office in Cincinnati, Ohio.

Clinton Corn Processing Co., division of Standard Brands, Inc., has opened a new $1-million research center at Clinton, Iowa.

Monsanto Chemical Co. has begun two major expansions of its Texas City, Tex., petrochemical capacity, boosting styrene monomer capacity by 40 million lb./yr., acetylene capacity by 12 million lb./yr.

Pacific Gas & Electric Co. plans to build a $330-million, 1,300-mi. pipeline system to bring natural gas from Alberta gas fields to California. Initial delivery of 400 million cfd. will begin in 1960.

Air Reduction Co.'s new polymer research laboratory at Murray Hill, N. J., is scheduled for completion at the end of 1957, will cost over $500,000.

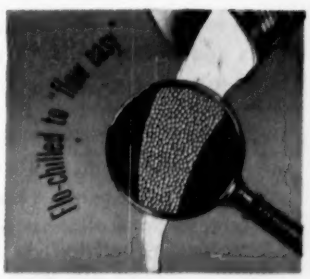
American Meter Co. has merged with its Philadelphia Pump and Machinery Co. subsidiary.



Dogs may have it bad in the hot humid period known as dog days. But, dog days are rough on anhydrous caustic, too!

However, you'll find that you can use new Wyandotte *Flo-chilled* Caustic Soda every day of the year — to advantage. Why? Because it's *Flo-chilled* at the factory to provide good flowability for you every day of the year.

Just try new Wyandotte *Flo-chilled* Caustic Soda, and you'll buy it for all your anhydrous-caustic needs. Your nearest Wyandotte branch office or distributor is the place to call . . . call soon!



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Wyandotte CHEMICALS

MICHIGAN ALKALI DIVISION

WYANDOTTE CHEMICALS CORPORATION, WYANDOTTE, MICHIGAN • Offices in Principal Cities



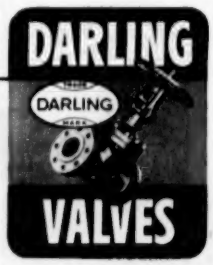
This gate valve idea saves time and money throughout industry!

DARLING gate valves, employing the principle shown in the cutaway above, offer a prolonged bonus in positive closure, freedom from trouble and long life. Such features as uniform wear distribution, elimination of disc-to-seat galling and compensated seating just naturally mean less maintenance, less down time, less expense through the years!

These trouble-free Darling gate valves are offered in sizes, types and metals for all kinds of normal or unusual services. Write for new Catalog No. 57.

ENGINEERING SERVICE: Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.

DARLING VALVE & MANUFACTURING CO.
Williamsport 3, Pa.
Manufactured in Canada by
Saudilands Valve Manufacturing Co., Ltd., Galt 19, Ont.



FIRMS . . .

Air Reduction Co.'s new polymer research laboratory at Murray Hill, N. J., is scheduled for completion at the end of 1957, will cost over $500,000.

Lummus Co. has sold its heat exchanger manufacturing division, with plant in Honesdale, Pa., to Yuba Consolidated Gold Fields. Price: $2 million.

B. F. Goodrich Chemical Co. has erected a $1.5-million center for synthetic rubber and rubber chemicals development at its Avon Lake, Ohio, experimental station.

U. S. Rubber Co. is spending a record $40 million on plant modernization and expansion during 1957. Activity centers on Philadelphia, Pa., which gets two $5-million investments—a new branch office and expansion of the Tacony plant.

Du Pont Co.'s Mexican subsidiary, S. A. de C. V., Mexico, D. F., plans to build a $2.8-million titanium dioxide pigment plant. Raw material, ilmenite, will be imported until local supply is developed.

B. F. Goodrich Co. has just purchased land in Exeter Borough, Pa., for an 80,000-sq. ft. textile plant. Plant, scheduled for operation in 1958, will process rayon and nylon for use in company's five tire plants.

Badger Mfg. Co. announced that it will build a $1.9-million, 1,430-bbl./day hydrofluoric acid alkyation plant at Enid, Okla., for Champlin Oil and Refining Co. Plant is based on Phillips process.

Dravo Corp. has opened a new half-million-dollar research center at its main plant in Pittsburgh, Pa.

Crucible Steel Co. has formally opened its expanded specialty steel warehouse in Chicago, Ill.

Superior Tube Co., Norristown, Pa., will build a $2-million office building and factory addition as part of a $5-million expansion program.

Frontier Refining Co., Denver, Colo., is spending $1.5-million to finance a 5,500-bbl./day expansion of its Cheyenne, Wyo., refinery.

Berkeley Chemical Corp. has completed a 100% expansion of cuprous chloride facilities at its Berkeley Heights, N. J., plant.

Balfour-Guthrie & Co. will soon produce 50,000 lb./day of synthetic resins in a new Tacoma, Wash., plant. Phenol-formaldehyde and urea-formaldehyde resins will be major products of the $300,000 installation.

Arkansas Chemical Co.'s new $250,000 plant at Malvern, Ark., is now producing montan wax, resins and drilling compounds from local lignite deposits.

Continental Oil Co. will modernize its Ponca City, Okla., refinery. Conoco is also building an atomic radiation lab at that location.

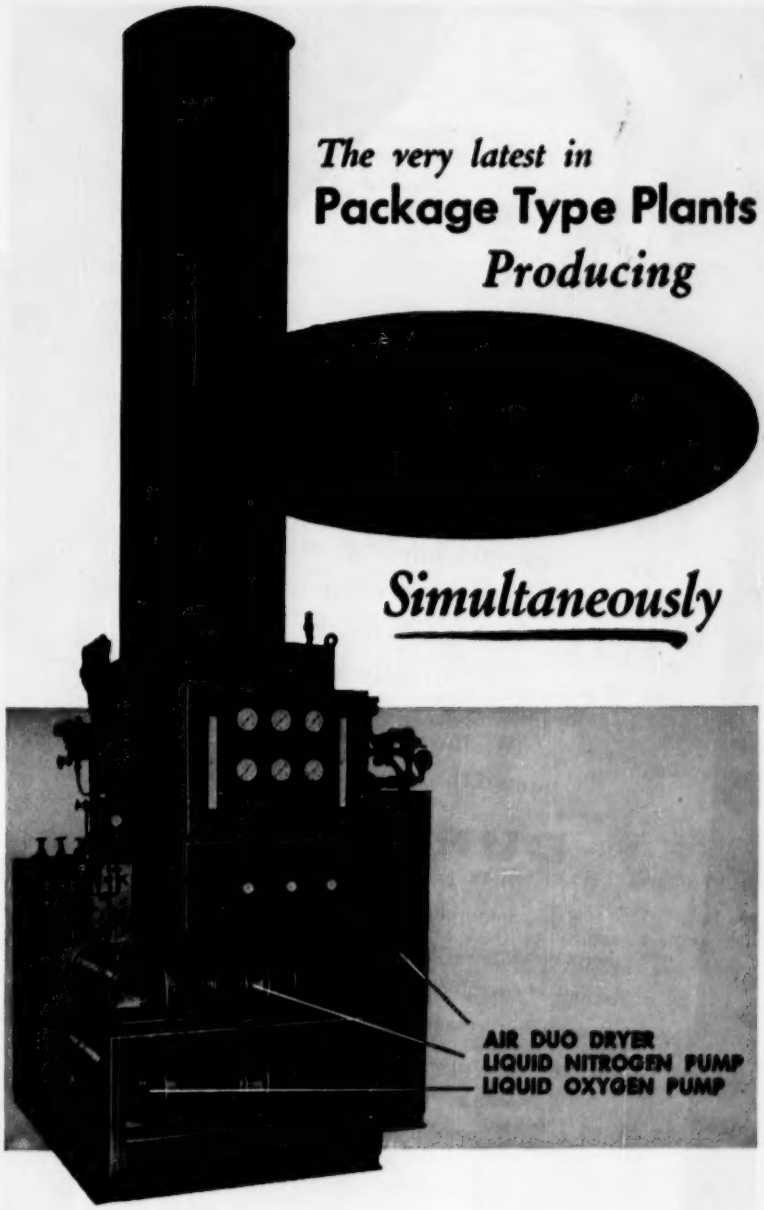
Linde Air Products Co. has acquired the business and assets of Independent Oxygen Ltd., Lethbridge, Alta., a major supplier of oxygen, acetylene and welding equipment in southern Alberta.

British Columbia Cement Co. is erecting a $1.5-million kiln on Vancouver Island at its Bamberton plant. Kiln ups cement capacity by 1 million bbl./yr. A $3.5-million plant modernization is also planned.

Rheem Mfg. Co. will build a plant in Tacoma, Wash., to provide 30- and 55-gal. steel drums for petroleum, chemical and other processors in the Pacific Northwest.

Scientific Design Co., New York, N. Y., announced completion

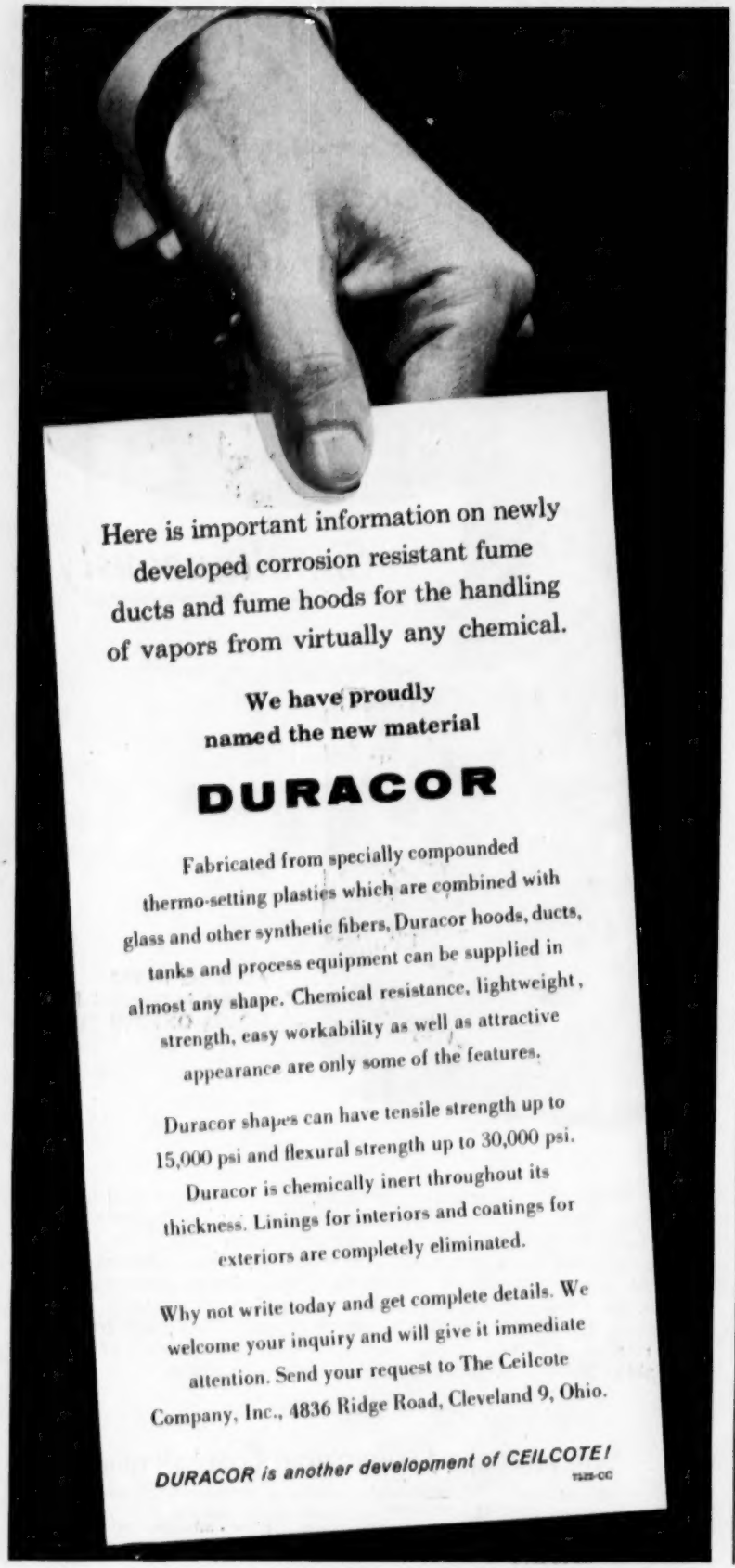
The very latest in
Package Type Plants
Producing
Simultaneously



With the introduction of our latest, improved design Package Type Generating Plants, production of high purity Oxygen and Nitrogen simultaneously *increases* production 60% over the production of Oxygen alone, *plus* a corresponding reduction in the *cost* of manufacture. Due to its compact design, a minimum of floor space is required and streamlined panel assembly insures instant visibility of all control gauges. Stock sizes from 1500 to 10,000 cu. ft. per hour. Larger and smaller sizes available. 99.99% Argon available on large size plants.

We invite your inquiry.

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CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE - OXYGEN - NITROGEN - ARGON
O'FALLON 7, ILLINOIS



FIRMS . . .

of a new plant in northern New Jersey for production of catalysts for SD-developed processes.

Raybestos-Manhattan, through purchase of Graef Engineering Co., Los Angeles, Calif., will manufacture Raylon and Teflon products on the Pacific Coast.

American Enka Corp. will soon begin a $5-million expansion of its Enka, N. C., nylon facilities. Plant capacity will be boosted by 75%.

Polychem Ltd., jointly owned by Dow Chemical Co. and Kilachand Devchand, has just started up a $6-million-pound/yr. polystyrene plant just outside Bombay, India.

Heyden Newport Chemical Corp., as part of its program for upgrading turpentine-based products, is building a new plant in Pensacola, Fla., to produce terpene alcohol esters.

Celanese Corp., at its Rock Hill, S. C., chemical terminal, is expanding facilities to provide storage space and shipping service for formaldehyde products.

American Synthetic Rubber Co. has expanded production facilities at Louisville, Ky. Costing $3.5 million, expansion increases synthetic rubber capacity by 25,000 long tons/yr.

Aluminium Ltd., Montreal, is constructing a half-million-dollar addition to its research facilities at Kingston, Ont.

Atlantic Refining Co. has licensed the German firm of Kali-Chemie to manufacture catalysts for the Catforming process.

Du Pont Co., by mid-1958, is scheduled to have a new $700,000 sales service laboratory at Chestnut Run, Del., to provide additional space for development of plastics processing and design techniques.

Braun-Knecht Co., San Francisco, Calif., has purchased the scientific apparatus, industrial chemical and hospital supply business of Denver Fire Clay Co.

Fluor Products Co. will use nearby redwood for prefabrication of cooling tower components in a new plant near Santa Rosa, Calif.

Cohu Electronics, manufacturer of communication and control instruments, has spent $250,000 expanding its San Diego, Calif., plant.

Central Farmers Fertilizer Co. has started construction on its $7,500,000 dicalcium metaphosphate fertilizer plant located at Georgetown, Idaho, plans to process 700,000 tons/yr. of phosphate rock.

Michigan Chemical Corp. will finalize engineering studies and plant design for a seawater magnesium oxide plant. A Gulf Coast site is planned.

Colonial Sugars Co. has formed a division to produce chemicals from sugar. Pilot plant is now working on sucrose esters.

Blue M Electric Co. is starting a 12,500-sq. ft. expansion of facilities for making temperature-controlled equipment.

Unexcelled Chemical Corp. has acquired assets of Federal Cement Tile Co., maker of fireproof roof panels.

Flexonics Corp., Maywood, Ill., will build a 25,000-sq. ft. plant in Santa Ana, Calif., to serve missile and aircraft industries with custom ducting systems, as well as providing standard industrial line.

Knowlton Brothers, Watertown, N. Y., industrial paper producer, will complete million-dollar modernization and plant expansion program at year's end.

Wyandotte Chemical Corp. will sell its limestone quarry at

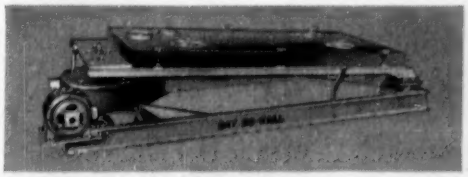
SIFT finer-faster-cleaner with DAY ro-balls

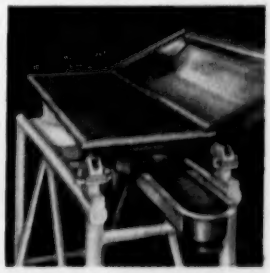


A few of more than 180 DAY ro-ball sifters in operation at a large midwestern plant.

Today thousands of products wet or dry, from flour to wood chips, are sifted through efficient, low-cost, high-production DAY ro-ball sifters. Superbly engineered, built for trouble-free operation under the severest service conditions, they insure longer life with lower maintenance costs.

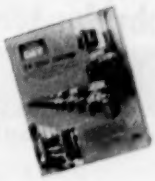
The exclusive super active ball cleaning device provides rebound points in each ball compartment, assuring fast, thorough sifting of your product. Gyrating action brings material into constant contact with every square inch of screen surface. A stabilizer maintains screen in horizontal position and insures smooth operation.


DAY standard ro-ball, available in six sizes, single or multiple screens. Single screen models in stock.


Stainless steel units available to meet food and dairy sanitary codes.

Many models are available so it is easy to choose one which will exactly suit your requirements. They can be used separately or in combination with DAY mixers or blenders to save product handling. A completely equipped lab is available for testing your product.

Write for new DAY ro-ball Bulletin.

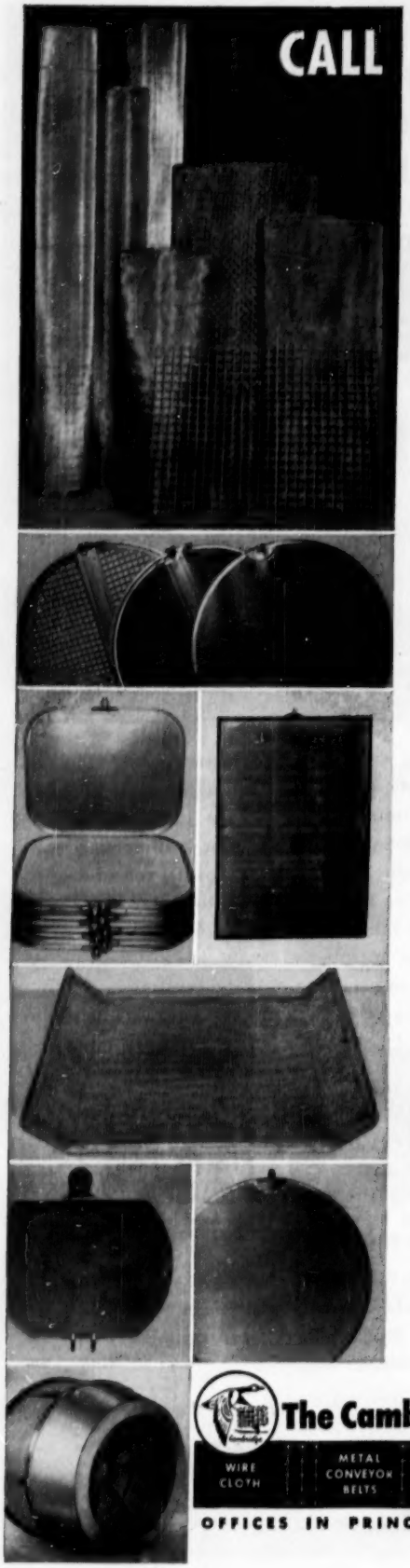


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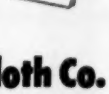
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Department G, Cambridge 9, Maryland

OFFICES IN PRINCIPAL INDUSTRIAL CITIES

FIRMS . . .

Alpena, Mich., to Huron Portland Cement Co. Wyandotte recently completed a $2-million expansion there.

Nichols Chemical Co. plans to manufacture a diverse line of industrial fine chemicals in a plant to be built in Valleyfield, Que.

Alloy Precision Casting Co., producer of mercury investment castings, is doubling manufacturing facilities at its Cleveland plant.

American Cyanamid Co. is building a new Flakeboard plant at Farmville, N. C. Capacity will be 40 million sq. ft./yr. of ¾-in. board.

General Chemical Div., Allied Chemical & Dye Corp., is now producing cotton insecticides from a new high-capacity plant in Cleveland, Miss.

Blaw-Knox Co. will design new $1.5-million sodium sulfate plant to be built at Coya Sur, Chile, for Anglo-Lautaro Nitrate Corp.

S. B. Penick & Co. has purchased Dow Chemical's aromatic chemicals compounding facilities, inventories and formulas. Penick will produce and market all aromatics formerly sold by Dow.

Pfanstiehl Laboratories, Waukegan, Ill., is expanding manufacturing facilities for its Seqlene line of sequestering agents.

Narmco Resins & Coating Co. is now operating a new 100,000-gal./mo. mixing facility for handling liquid adhesives and resins. Expands productive capacity 500%.

Utah Oil Refining plans $16.2-million, five-year expansion program in intermountain West, including 6,000-bbl./day hike in capacity of Indiana Standard subsidiary's 29,000-bbl./day refinery.

Allied Chemical & Dye Corp. will erect a liquid aluminum

sulfate plant in Pine Bluff, Ark., to supply paper mills in that area.

Aluminum Co. of America's multimillion-dollar, 500,000-ton/yr. alumina plant at Point Comfort, Tex., is one-fifth completed. Will process bauxite from South America and Caribbean area.

Dresser Industries' manufacturing division has completed a 100,000-sq.-ft. compression fitting plant in Wellsboro, Pa., costing $1 million.

Republic Steel Corp. will spend $14 million on two new batteries of coke ovens at its Cleveland plant. Replacing outdated coke ovens, new units will have 20% greater capacity.

Victor Chemical Works is completing engineering plans for a 50-employee, multiunit organic chemicals plant at Mt. Pleasant, Tenn. Construction is expected to begin in a few weeks.

United States Steel Corp. has dedicated a nitrogen plant at its Geneva Works, Provo, Utah. Plant, utilizing several Montecatini processes, will produce anhydrous ammonia, nitric acid and ammonium nitrate.

Heyden Newport Chemical Corp. will produce FF grade rosin, turpentine, pine oil and dipentene at a new Telogia, Fla., plant.

Archer-Daniels-Midland Co. has expanded into West Germany, building a plasticizer and synthetic resin plant in Ruhle. German and Netherland interests are partners in the venture.

Signet Distilleries, with production scheduled for late 1958, is building a $2.3-million, 27-million-gal./yr. plant in Saskatoon, Sask.

Petrochemicals Industries Ltd., Edmonton, Alta., is undergoing a $100,000 expansion.

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PUMPS,
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General Service Unipump for use where space is limited

Single-Stage Horizontally Split-Case Pump for high head service

Type U Non-Clogging Pump for liquids carrying solids

The outstanding feature of a truly great ballplayer is his ability to turn in above average performances, day after day.

So it is with WEINMAN PUMPS. Day in, day out, rugged, dependable WEINMAN PUMPS turn in top-notch performances wherever industry encounters liquid handling problems. Just what does this mean to you and your plant operations? It means lower operating costs, less maintenance expense, less downtime due to pump failure. And WEINMAN PUMPS cost less to buy, too.

Be smart . . . don't pay big league prices for minor league pumps. Make sure you get the league's top performers . . . sturdy WEINMAN PUMPS. They're designed right and built right to operate right.

See your nearest WEINMAN Specialist for full information. He'll be glad to help you solve your plant's pumping problems. You'll find his name in the yellow pages of the phone book. Or write, wire or phone us direct.

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FILTRATION *Engineered** TO MEET CHEMICAL PROCESSING NEEDS

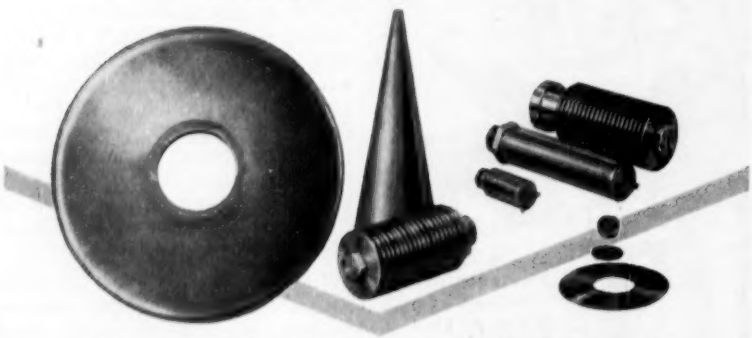
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THE POROUS STAINLESS STEEL MEDIUM FOR LIQUIDS, GASES AND STEAM THAT COMBINES ALL THESE UNUSUAL FILTRATION CHARACTERISTICS —

- **HIGH HEAT RESISTANCE** . . . for operating temperatures as high as 900°F.
- **HIGH TENSILE STRENGTH** . . . to 15,000 psi, able to withstand differential pressures of more than 3500 psi.
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- **AVAILABLE** . . . as cartridge-type filters and as specially fabricated or preformed elements. A complete line of standard or special high pressure coded Cuno Housings are available.



*Because no *one* type of filter is best for every need, Cuno – and *only* Cuno – offers you a truly complete line that includes *several* distinct types of filtration media. And because every filtration system must be specified and engineered to individual job requirements, Cuno also offers you a complete application engineering service through the Cuno Field Engineer. Conveniently located in your area, one of these specialists is ready and fully qualified to help select the filter type and model exactly right to solve your problems.

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EDGE-TYPE, WIRE-WOUND, SCREEN, FIBER CARTRIDGE and POROUS METAL FILTERS

Filtration Engineers in Principal Cities

FIRMS . . .

Plant fabricates polyethylene into piping, tubing, sheet and film.

United States Lime Products Corp. is building a $2-million lime plant at Arrolime, Nev. The 400-ton/day unit will service all parts of the U. S.

Du Pont Co.'s Electrochemicals Dept. will construct a $2.5-million research and development lab adjacent to the plant at Niagara Falls, N. Y.

Borg-Warner Corp.'s Weston Hydraulics subsidiary will undergo a multimillion-dollar expansion. Initial step is a new equipment plant for aircraft industry at Van Nuys, Calif.

Norton Co. has initiated work on a $6.5-million grinding wheel plant in Worcester, Mass.

Sterling Drug Co. will expand its Rensselaer, N. Y., research facilities in order to enter the field of biological chemicals.

L. L. Constantin & Co., manufacturer of glass-to-metal seals, acquired a 20,000-sq. ft. building in Saddle Brook, N. J., to expand its miniaturized products facilities.

Texas Co. is building a 180-ton/day ammonia plant at Lockport, Ill. Plant will be completed by the end of this year.

Minerals Engineering Co., Grand Junction, Colo., will join with Rockefeller Center, Inc., New York City, and High Speed Steel Alloys, Ltd., England, in the construction of a 3.6-million-lb./yr. vanadium mill in Union of South Africa.

Scholven-Chemie AG, Gelsenkirchen, Germany, petrochemical firm, will expand petroleum processing capacity from 750,000 to 2 million tons/yr.

Calumet & Hecla of Canada is spending over $7 million for

a mill—believed to be Canada's first—to produce seamless copper and copper-alloy tubing at London, Ont.

Florida State University's proposed nuclear center will house, in 1959, one of the world's first 10-mev. Van de Graaff tandem accelerators. The 35-ton tandem will be two 5-mev. particle accelerators placed end to end with a common voltage terminal.

Air Force's rocket engine test laboratory near Boron, Calif., soon will be the site of a $5.5-million liquid oxygen plant. Facilities will produce up to 150 tons/day of liquid oxygen (for rocket engine tests) and up to 15 tons/day of liquid nitrogen.

Sun Chemical Corp., Long Island City, N. Y., has purchased Bensing Bros. & Deeney Co., manufacturer of flexographic inks.

Carborundum Co. will spend about $1 million to boost silicon carbide capacity of its Vancouver, Wash., plant by 35-40%.

Mississippi Chemical Corp. has awarded a contract to Chemical & Industrial Corp. for design and construction of a 150-ton/day nitric acid plant at Yazoo City, Miss. On-stream date: early 1958.

Pacific Coast Borax Corp. has nearly completed its new $18-million borax plant at Boron, Calif.

Du Pont Inter-America Chemical Co. will build a paint plant in Cuba to manufacture Du Pont finishes for the Cuban market. Manufacturing will begin about Sept., 1958.

Aluminum Co. of America is planning a $54-million plant expansion at its Davenport, Iowa, sheet and plate plant.

Cerro de Pasco Corp. has acquired the business and assets of Lewin-Mathes Co.

DENVER PROCESS EQUIPMENT

DENVER (patented) **SUPER AGITATORS and MIXERS**		3'x 3' to 20'x 20'	Patented standpipe around propeller shaft assures positive agitation and circulation. Patented wearing plate prevents sand-up on shut-down. Heavy duty as well as acid-proof construction is available in both open type, air lift and Super Agitator models. Please write for Bulletin No. A2-B4.
DENVER Steel-Head **BALL MILL**		3'x 2' to 8'x 20'	A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. B2-B13.
DENVER Automatic **SAMPLERS**		16" to 60" Cutter Travel	Heavy duty units, extra rigid track and ball-bearing wheels assure positive travel and timing of sample cutter. Available in stainless steel for acid and corrosive service. Wet and dry cutters. Central Control Panel for multiple samplers. Bulletin No. S1-B4.
DENVER Forced-Feed **JAW CRUSHER**		2¼" x 3½" to 36" x 48"	Cast Steel Frame, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection and thus increase life of heavy-duty, oversize roller bearings in bumper. Setting easily controlled. Please write for Bulletin No. C12-B12.
DENVER Wet Reagent **FEEDER**		0 cc to 2000 cc	Accurately meters minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Handwheel adjustment to control amount of liquid is simple and accurate. Used in multiples for higher capacities. Please write for Bulletin No. F6-B9.
DENVER Disc **FILTER**		1 Disc, 2' to 12 Disc, 9'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Filters. Please write for Bulletin No. F0-B1.
DENVER "Sub-A" **FLOTATION**		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-B81.
DENVER Wilfley Concentration **TABLES**		5 to 150 T/24 Hrs.	A mechanically operated, longitudinally reciprocating table consisting of a deck having a plane surface partly riffled and a tilting device. It separates materials into bands and handles the coarsest sands with excellent results. Ideal for separation of groups of particles having a similar range of specific gravities. Write for Bulletin No. T1-B3.
DENVER LABORATORY EQUIPMENT		Batch or Continuous	Batch and continuous test models of Crushers, Screens, Ball Mills, Pulverizers, Rod Mills, Classifiers, Agitators and Mixers, Pulp Distributors, Feeders, Flotation Machines, Pumps, Thickeners, Filters, Dryers, Tables, Samplers. Results obtained on Denver Laboratory Equipment can be duplicated by commercial machines. Please write for Bulletin No. L03-B10.
DENVER Standard **DRYERS**		2'x 15' to 5'x 40' and larger	Available in several types: Direct Heat, Indirect Heat, and Steam Tube. Let DECO Engineers solve your drying problem. No dryer problem too small or too large. Please write for Bulletin No. D4-B2.

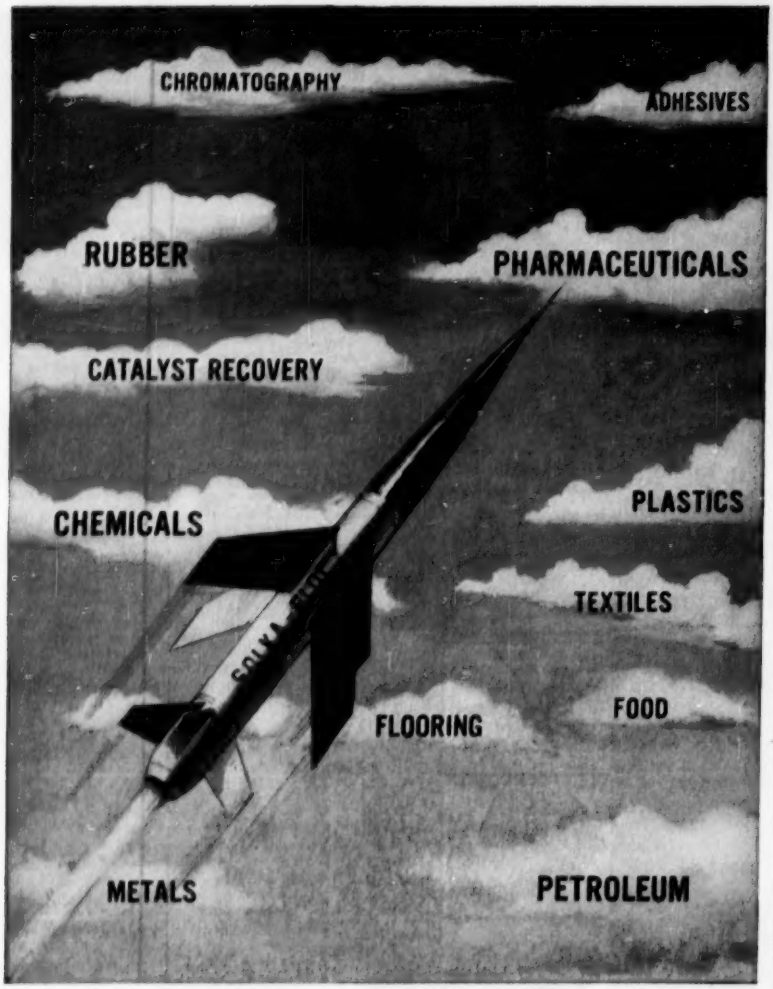
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2 As an Adsorbent in Chromatography.

3 In the manufacture of Chemical Derivatives of Cellulose.

and—as a filter aid.

In this application SOLKA-FLOC gives you greater, more economical volume of clarified filtrate because its finely divided particles trap the tiniest of suspended solids. It makes a stable pre-coat, does not "bleed" and there's no loss of cake due to pressure drop, no abrasion of pumps and valves, minimum retention of filtrate in filter cake.

SOLKA-FLOC effectively adsorbs many metals such as iron, copper and other impurities and can be burned to recover valuable solids. Let us show you how SOLKA-FLOC* will do a better job for you in your product or your process. Address Dpt. FD-9 our Boston office.

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*Sold in Canada by Brown Forest Products, Ltd., Montreal, Que. (Alpha-Floc)

FIRMS . . .

Minneapolis-Honeywell has opened a new $1.5-million plant to produce industrial valves in Fort Washington, Pa., near Philadelphia.

National Vulcanized Fibre Co. has placed in operation a new plastics and fiber fabricating plant at Los Angeles, Calif., will boost firm's over-all fabricating capacity by more than 10%.

NEW COMPANIES

De Laval-Holroyd Inc. is the new firm formed by De Laval Steam Turbine Co. and John Holroyd & Co., Ltd., of Milnrow, Lancashire, England.

Materials Research Corp. has been organized to advise industry on metallurgical and general materials problems. Laboratories are in Yonkers, N. Y.

Consulting Associates, Cleveland, Ohio, has been formed to offer consulting services in all branches of engineering and chemistry.

Sidaplex, S. A., a Belgian firm, has been formed to make and sell plastic bottles and films. Principal shareholders are Plax Corp. and Societe Industrielle de la Cellulose.

Phillips Pacific Chemical Co.'s new $15-million Coulee ammonia plant, near Kennewick, Wash., has started production.

NDA Europe, a firm to develop commercial atomic energy in Europe, has been formed by Nuclear Development Corp. and two Belgian firms, will have offices in Brussels.

Collier Carbon and Chemical Corp., has been formed by merger of Brea Chemicals, Inc. and R. T. Collier Corp., subsidiaries of Union Oil of Calif.

Formica Ltd. will be organized in Great Britain by American Cyanamid and Thomas De La Rue & Co., Ltd., London.

J. B. Durra & Co., with offices in Chicago, has been set up to specialize in marketing and financial services for the plastics industry.

Celene, S. P. A., formed by Union Carbide and Societa Edison of Milan, will manufacture high-pressure polyethylene in Italy.

FMC International, a new division of Food Machinery and Chemical Corp., San Jose, Calif., will facilitate company's world-wide trade.

Shinko Acrylic Fiber Co. is the name given to the firm set up by Chemstrand Corp. and Mitsubishi Rayon Co., Ltd. for manufacture of acrylic fiber in Japan.

Jefferson Chemicals Co. has formed an alkali sales division to market alkali formerly handled by American Cyanamid Co.

W. L. Badger and Associates, Inc. is a newly created consulting engineering firm with offices in Ann Arbor, Mich.

Laing-Ferguson Co., an association of H. K. Ferguson Co., Cleveland, and John Laing & Son Ltd., London, will provide overseas service for both construction firms.

Witco Chemical Co., Canada, Ltd., will manufacture and sell basic industrial chemicals throughout Canada.

Canadian Badger Co., Ltd. is newly established to design and build oil and chemical processing plants in Canada. Offices are in Toronto, Ont.

Pfaudler Permutit will be the name of the merged Pfaudler Co. and Permutit Co., if shareholders of both firms approve the merger.

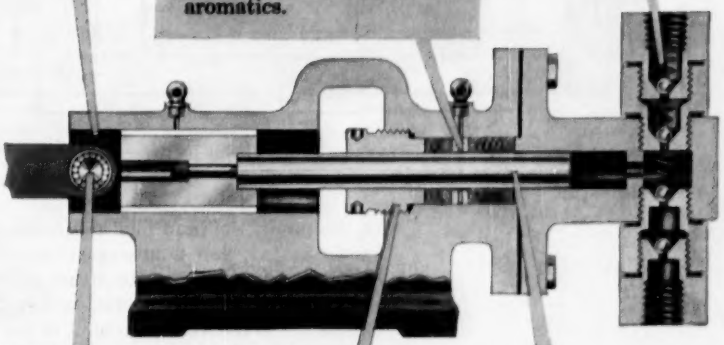
Arkansas Cement Corp., new wholly owned subsidiary of Arkansas Louisiana Gas Co., will build and operate a $15-million Cement plant at Foreman, Ark. Target on-stream date: late next year.

PICK THIS PUMP
for reliability and maintenance economy...

CROSS HEAD is oversized, running in carefully machined guide—preventing usual pump failures at this point. All moving parts and packing can be removed without breaking piping connections.

LIQUID ENDS: Valves are machined from solid stainless steel. No pressed seats to work loose. Valve balls are hardened and ground, and stainless steel spring-loading insures instant response, even on viscous liquids and slurries.

LANTERN RING readily changed from grease to water or oil seal for handling crystallizing liquids, slurries, corrosives, volatile toxics, aromatics.



CONNECTING ROD BEARINGS—hardened and ground pins running in grease lubricated needle bearings, replace the usual rapidly-wearing bronze bushings.

PISTONS are stainless steel, ground and polished. Accurate capacity control is obtained by piston stroke length adjustment. Adaptable to both manual control and instrumentation.

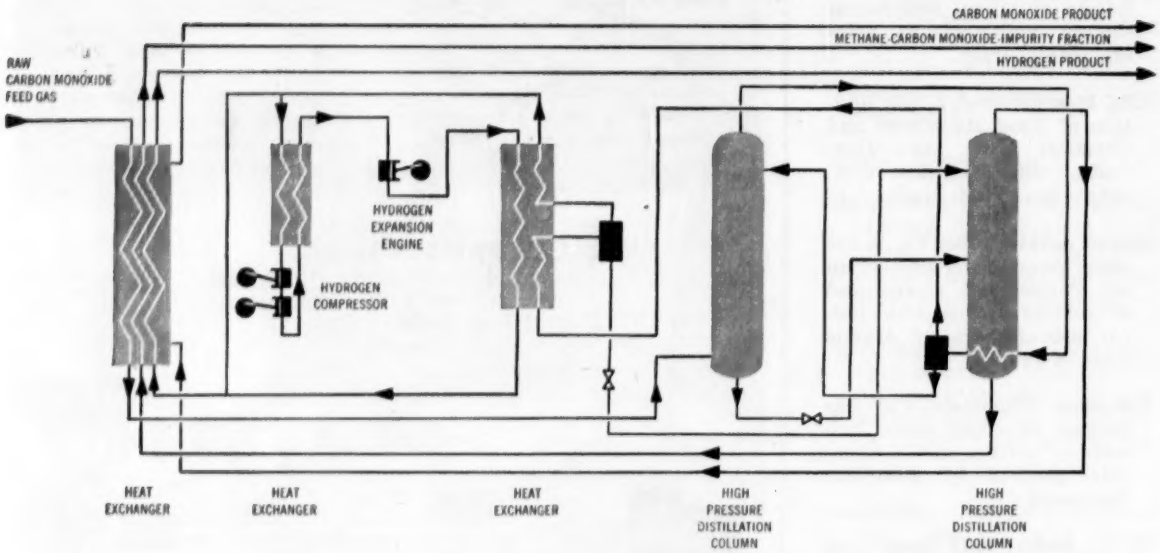
PACKING GLANDS are easily accessible at both ends to simplify packing replacement. Gland take-up is a screwed nut, insuring even pressure on packing—no cocking, less packing trouble.

For more facts about Philadelphia type S Pumps — for 85% of all chemical pumping needs — write for Bulletin S-1254.

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A new approach to production and purification of carbon monoxide from crude synthesis gas



In the production and final purification of carbon monoxide from crude synthesis gas, low-temperature processing plays an important part. Synthesis gas—produced by steam reforming or various partial oxidations—contains CO, H_2 and some carbon dioxide. From this composition, it is possible to recover up to 95% of the CO, as a product of up to 99.5% purity, using low-temperature equipment designed and built by Air Products, Incorporated.

Air Products carbon monoxide purification plants feature:

. . . high-purity carbon monoxide and hydrogen product streams
. . . maximum recoveries—higher capital return
. . . automatic control—minimum labor requirements
. . . low power consumption
. . . factory assembled plants—with low installation expense

Low-temperature processing is not limited to just this type of gas purification. Designs are available and plants have already been built for such processes as . . . recovery of helium and nitrogen, separately, from natural gas . . . purification of methane . . . recovery of pure hydrogen from cracked petroleum off-gas streams. New processes are constantly being developed, and can be tailored to your needs.

Integrated design, manufacture, erection and operation of Air Products plants makes possible guaranteed results . . . for gas separation, liquefaction and purification systems. Plants are built to customer specifications. Ask us how low-temperature processing can be put to work for you. Your inquiry is invited. Air Products, Incorporated, P.O. Box 538, Allentown, Pa.

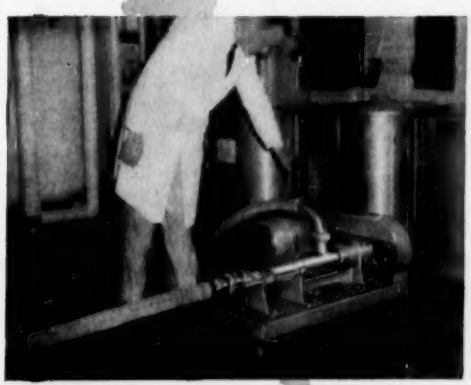
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MOYNO® PUMPS

CUT HANDLING COSTS at Merck Sharp & Dohme, Division of Merck & Co., Inc.



...pumping mouthwash and general alkaline solutions



Moynos, with their "progressive cavity" pumping principle, provide a vital production lifeline at Merck Sharp & Dohme, Division of Merck & Co., Inc. They use Moynos to pump a variety of products, from water-like mouthwash to heavy pastes with viscosities up to 20,000 centipoise. The pump at the left, with a capacity of 30 GPM at 600 RPM, moves mouthwash and general alkaline solutions. Moynos have enabled thousands of plants to pipe different materials formerly moved by hand and other expensive means. They are the only pumps that will handle many difficult materials such as abrasives, pastes, slurries, chemicals, foods, suspended solids, etc., without foaming, aerating, crushing or excessive pump wear.

Examine your processing methods. No doubt there are several places where Moyno Pumps can drastically cut costs. Ask us. We'll give you a prompt answer. Send us an outline of your problem today! Write for Bulletin 30-CE.

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Motors · Fans · Hoists · Moyno® Pumps · Propellair® (Industrial) Fans

Continental FIBRE DRUMS

For variety, versatility, and value, the finest shipping container available

When you pack your products you ask one basic question . . . will they be safe in shipping or storage? The answer to that all-important question is always yes, if you pack your product in one of the many fine Continental Fibre Drums.

Continental containers are tailor-made to meet the specific needs of your products. You have the widest choice of size, style, and design, plus the assurance of a fibre drum with exceptional durability. A real top-quality container. And you get real value, too, because the light weight of these fibre drums cuts down on freight costs.

So get all the advantages offered to you in Continental Fibre Drums . . . Leverpak, Stapak, or Fiberpak. You always get the finest from Continental.

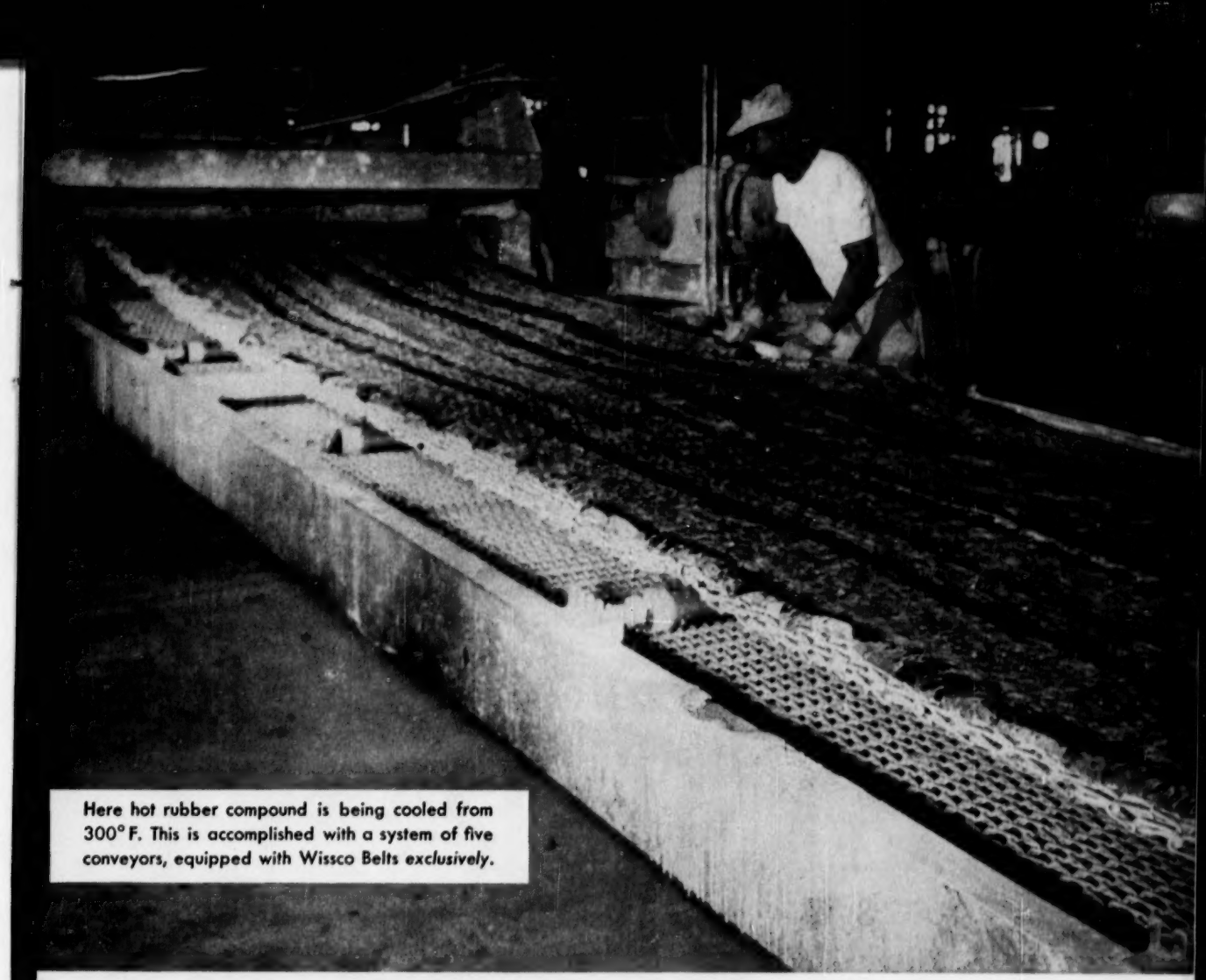


TAILOR-MADE PACKAGE SERVICE

CONTINENTAL CAN COMPANY

FIBRE DRUM & CORRUGATED BOX DIVISION, NEW YORK, N. Y.

Van Wert • Philadelphia • Pittsburgh • Tonawanda • Cleveland • Chicago • Atlanta • St. Louis • San Francisco • Los Angeles • Eau Claire • Boston



Here hot rubber compound is being cooled from 300° F. This is accomplished with a system of five conveyors, equipped with Wissco Belts *exclusively*.

FAMOUS NAMES

ride on WISSCO BELTS

Goodyear Tire and Rubber Company • Topeka, Kansas

Goodyear, a name long known for top-quality rubber products, has been using Wissco Belts for cooling operations in its Topeka, Kansas, plant for more than a decade.

Each belt in this system handles over 12,000 pounds of hot compounded rubber product per hour . . . 23¼ hours a day . . . six or seven days a week. With the average belt service having proved to be two years, this means that *each* belt conveys more than *17 million* pounds of rubber during its lifetime.

Years before the Topeka plant was opened in 1945, Goodyear had been testing, evaluating and using Wissco Belts in its Akron plant—with uniformly good results. No wonder then, for the past twelve years, Goodyear has specified *only* Wissco Belts for its Topeka cooling operations.

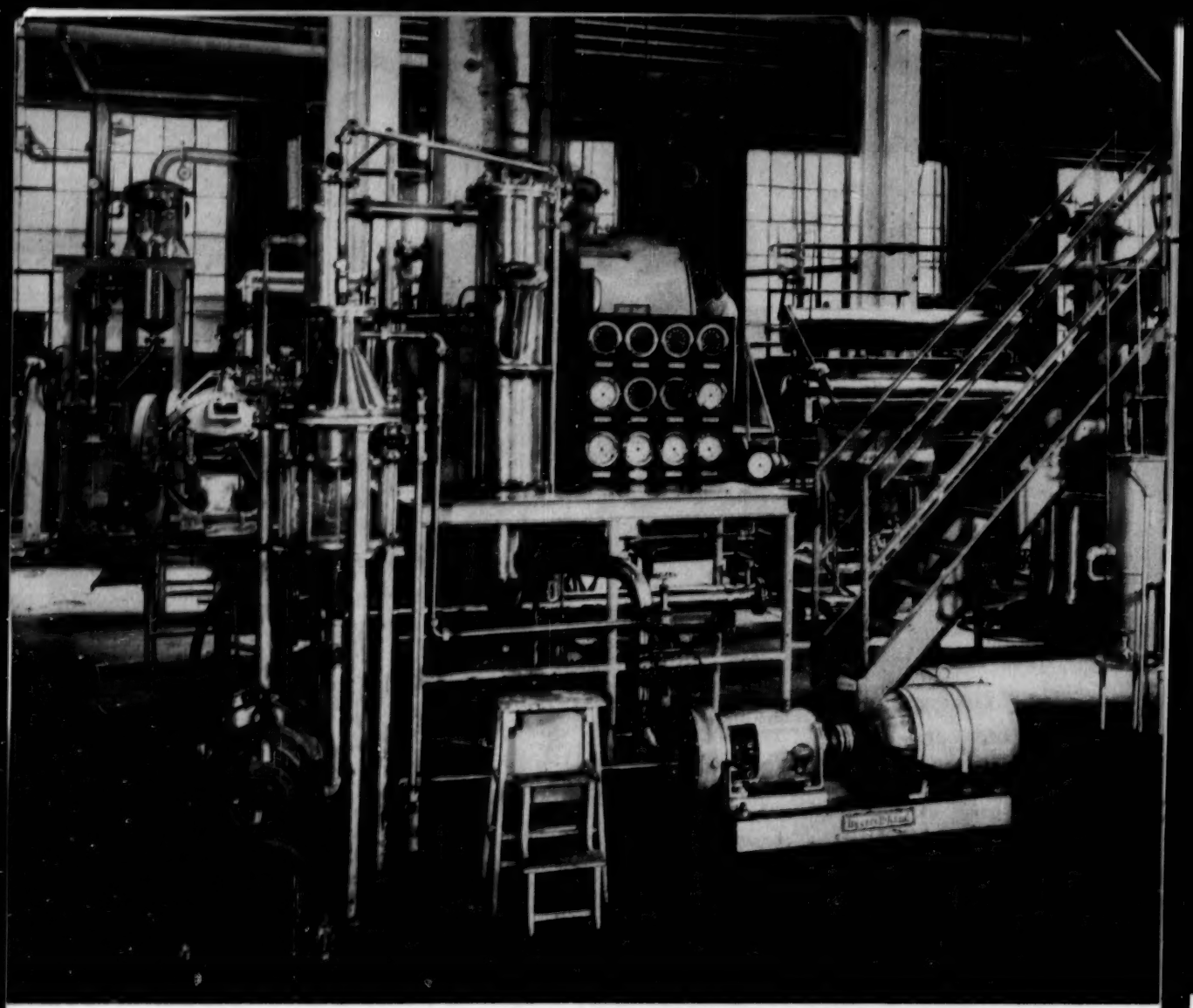
As with Goodyear, Wissco Processing Belts are the choice of many famous names in industry—leaders in their fields. If you are not already a Wissco Belt user, it'll pay you to get full details on how these efficient and economical belts can help you in your own operations.

THE COLORADO FUEL AND IRON CORPORATION
Denver and Oakland
WICKWIRE SPENCER STEEL DIVISION
Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia
CF&I OFFICES IN CANADA: Montreal • Toronto

CF&I **WISSCO BELTS**

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

4632



Buflovak puts the best equipped processing lab at your service

Buflovak laboratory has solved over 7000 processing problems. This thorough research, conducted by an experienced staff of skilled engineers, has lead to many new methods now in use in the chemical, food, pharmaceutical and allied fields.

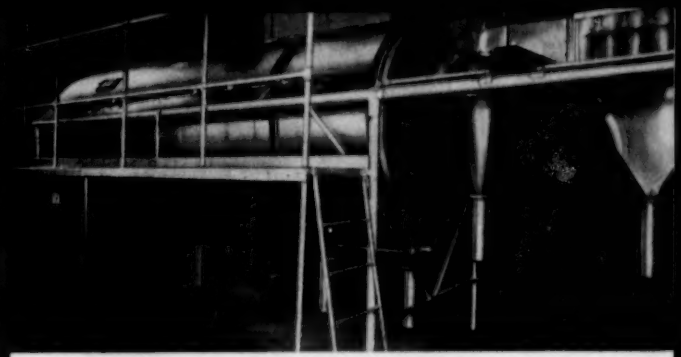
Buflovak's research and development center is the world's most completely equipped processing laboratory for investigating drying, evaporation, extraction, impregnation, crystallization and other related processes.

Here you can obtain accurate performance data on your product . . . examine your process efficiency . . . explore by-product possibilities. Whether you test a few beakers of precious material or run tank car quantities on a round the clock production scale, you get proof positive on the operation.

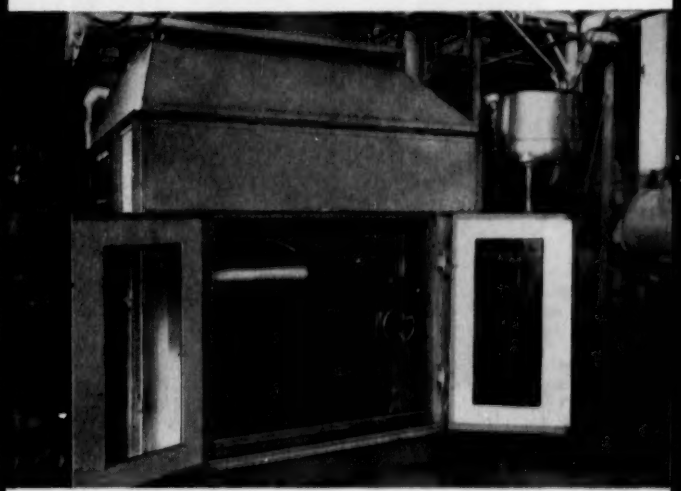
Buflovak laboratory is a complete processing plant equipped with a variety of small experimental units and semi-plant size equipment. New models are continually installed, so that the testing apparatus is always the latest obtainable.

Constant research makes Buflovak designs the most modern in the field, the most dependable in operation. Because Buflovak builds a complete line of processing equip-





When experimenting with high recovery of solids, this pilot plant Spray Dryer is often used. Instantaneous drying from liquid to dry product provides new product characteristics, opens up new markets for chemical, pharmaceutical and food manufacturers. Noted for its low initial cost, Buflovak Spray Dryers assure low maintenance costs.



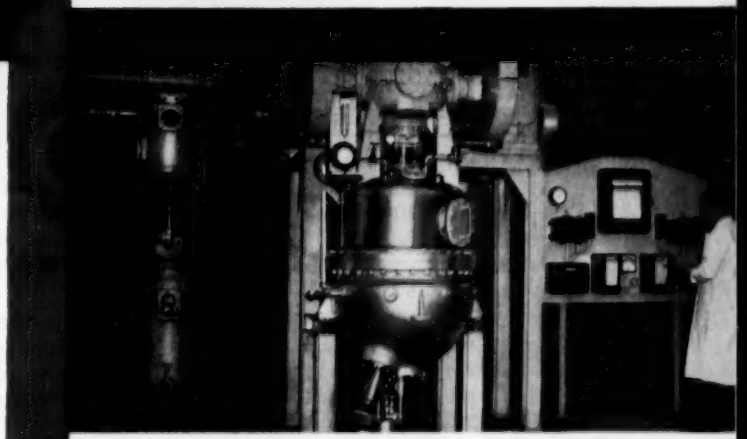
How to handle dusty or toxic materials is another aspect of Buflovak research. Dyes, herbicides and other materials can cause serious dust and fire hazards, often release toxic solvents. Buflovak enclosed Double or Twin Drum Dryers have been found to offer complete safety against these dangers, and to permit the reclaiming of important solvents.

▲ **Testing evaporation.** This Forced Circulation Evaporator (above at left) is used to concentrate heavy liquids. Buflovak evaporators are designed to fulfill a particular application . . . to provide a virtually complete recovery of solids . . . to produce a finished product suited to market and process requirements.

ment—such as evaporators, dryers, kettles, autoclaves and flakers—it can impartially recommend the units that sound research indicates the best.

Take advantage of Buflovak's 50 years experience. Your engineers are invited to consult our staff without obligation.

For details, write for Catalog 358.



Concentrating, mixing, reacting and many other processes are checked in this 50-gallon Stainless Steel Processing Kettle. Tests can be run at atmosphere, under pressure or at full vacuum. It is equipped with a double motion agitator with separate variable speed drives for each agitator element.

BLAW-KNOX

BLAW-KNOX COMPANY

Buflovak Equipment Division

1551 Fillmore Avenue, Buffalo 11, N. Y.

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

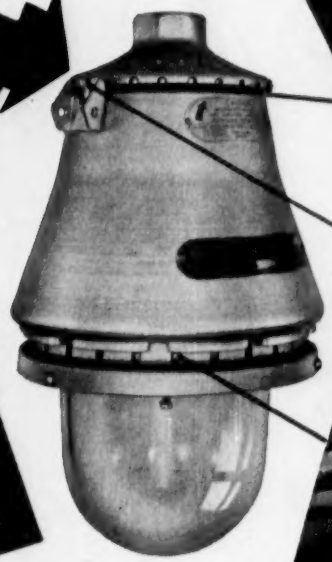
Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

APPLETON "AA-51" SERIES VENTED EXPLOSION-PROOF LIGHTING FIXTURES



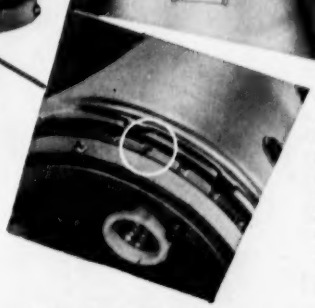




Close-up showing canopy, extra-safe multiple "AA-51" contact threads, and anti-vibration guard with V-shaped metal prong before engaging canopy notches.



Canopy is securely locked against vibration disturbance by positive engagement of V-shaped metal prong in tightly sealed canopy notch. This anti-vibration guard may be quickly released by hand pressure for maintenance.

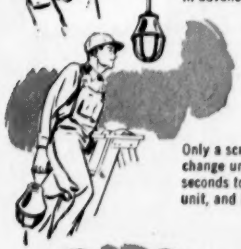


Similar in action to canopy guard, this close-up shows anti-vibration guard locking globe ring to dome unit assembly. Metal prong in dome unit is securely engaged by notched globe ring to prevent accidental loosening. This anti-vibration guard also may be quickly released by hand pressure for maintenance.



58 Second Relamping

Series "AA-51" stand-by units are ready at an instant's notice for relamping... with handles attached in advance.



Only a screwdriver is needed to change units . . . and only 58 seconds to climb ladder, change unit, and descend.



Cleaning fixtures, changing burned-out lamps, can be done safely at bench . . . preventing costly shutdowns.

The fixture with "all" the features now sets even greater standards of efficiency and safety!

APPLETON's new anti-vibration guard on all "AA-51" vented explosion-proof fixtures assures users of positive protection against spark caused mishaps due to vibration conditions. Coupled with multi-thread safety design where a "flame-tight" contact chamber permits servicing *even with the current on*, this new anti-vibration guard demonstrates APPLETON's continuing quality research program to bring you the finest in electrical products. Check these other features for proof of "AA-51" design leadership and adaptability for your requirements. Write for complete information today.

Sold through franchised wholesalers only



"Full Circle Venting"
Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.

APPLETON ELECTRIC COMPANY
1742 Wellington Avenue, Chicago 13, Illinois

APPLETON ELECTRIC PRODUCTS

Also manufacturers of:



Industrial Lighting Equipment



Automatic Reelites



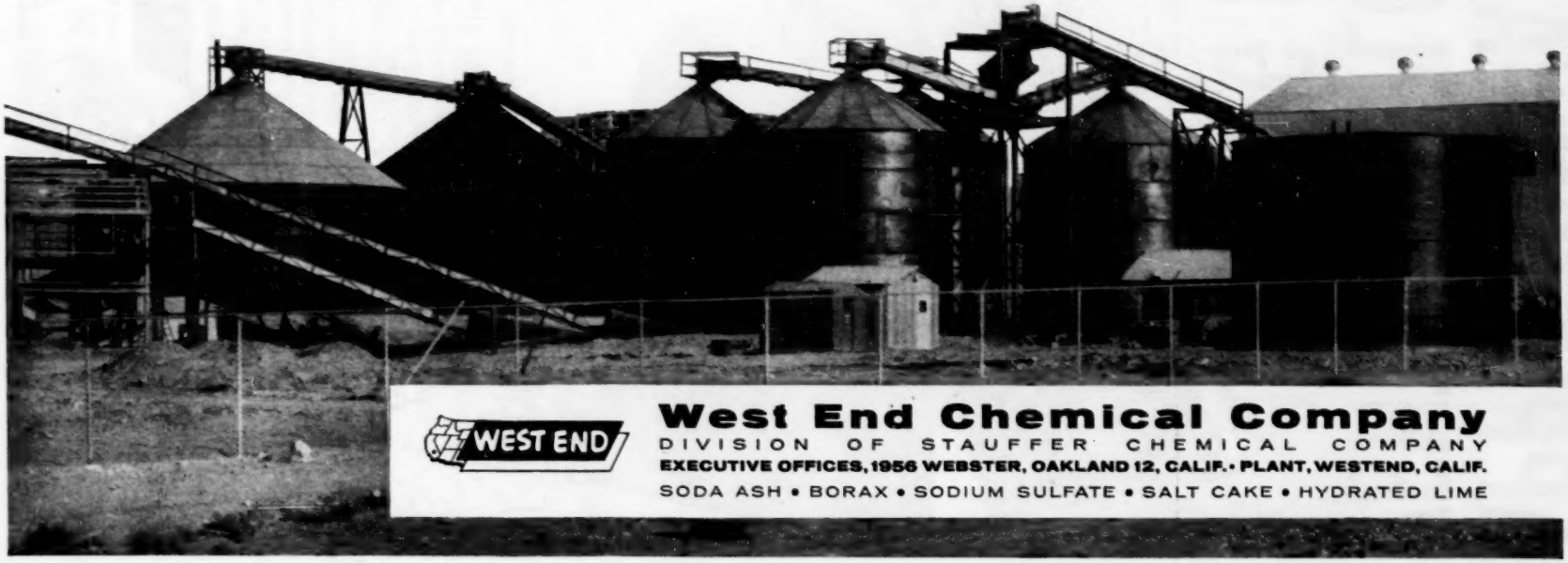
"51" Series Connectors



Malleable Iron Unilets

if you needed an extra 1,000 tons of West End anhydrous SODIUM SULFATE today, we'd have it for you . . .

Our customers generally schedule their requirements far in advance—sometimes for years—but on those occasions when additional quantities are needed unexpectedly, West End has the storage facilities to meet any emergency requirements promptly and easily.



WEST END

West End Chemical Company

DIVISION OF STAUFFER CHEMICAL COMPANY

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.

SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

SCRUBOSPHERE* ...



... FOR *Cleaner Gas* AT *Less Cost!*

*PEERLESS SPHERICAL
DUST and LIQUID SCRUBBER
FOR GAS PIPELINES

(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving thru liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3

- The **dust removal ability** of the SCRUBOSPHERE **is superior** because it utilizes wetted surfaces for dust collection which are much more closely spaced than in conventional equipment.
- **Oil loss is minimized** because the oil used to wet the dust collecting surface is lifted mechanically instead of bubbling gas through the oil which results in foaming and loss due to creation of hard-to-separate fine particles.
- **Maximum performance and low cost** — The spherical design means high capacity and performance because it provides maximum dimensions for the contactor and mist extractor which normally are limiting factors in scrubber designs. The vessel cost is reduced because required vessel thickness is only one half that required for cylindrical vessel of same diameter.
- **Versatility** — separates solid and liquid particles with equal efficiency.
- **Low pressure drop** — ½ to ¾ psi at rated capacity depending on nozzle size.

PEERLESS MFG. CO. DALLAS TEXAS

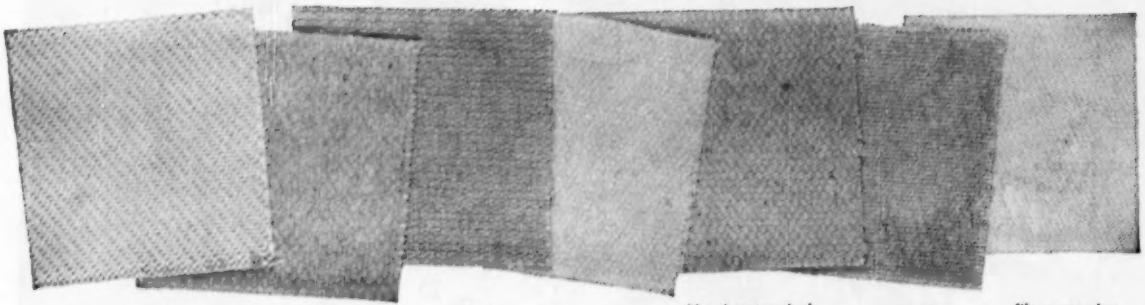
PEERLESS MANUFACTURING CO.

P. O. BOX 13165 DALLAS, TEXAS

Representatives in All Principal Cities

Write for test data showing dust removal and oil loss of Peerless Scrubosphere as against conventional dust scrubber.

How many of these filter fabrics



filament nylon twill | cotton filter duck | spun dynel | spun nylon | No. 4 cotton duck | spun dynel twill | filament nylon

can you match up with these jobs?

1. filtering gluten on iron plate-and-frame presses	?
2. separating dye intermediates from a HCl and H_2SO_4 solution at 45° C.	?
3. filtering clay slurries	?
4. filtering NaOH at elevated temperatures	?
5. clarifying thick beet sugar juices at 90° to 96° C.	?
6. filtering coal slimes on continuous vacuum filters	?
7. filtering oil and glycerin under 200° F.	?

The typical Wellington Sears filter fabrics shown here were actually assigned the filtration jobs listed above. They were the answers in *these* particular cases; on other occasions, and under other circumstances, another fabric or another construction might have been specified, according to the needs of the actual problem. Which means a great deal of information must be accumulated and examined —information which you obviously would need in order to answer our "question" headlined above. But this "impossible" exercise does serve to make one point very strongly: that it takes a filter fabric specialist to establish and evaluate *all* the requirements of *each* job, to determine which filter fabric to use. That's why our experience, and the experience of the people who distribute our filter fabrics, can be so helpful to you. Just call. For free copy of "Filter Fabric Facts," address Dept. L-9.

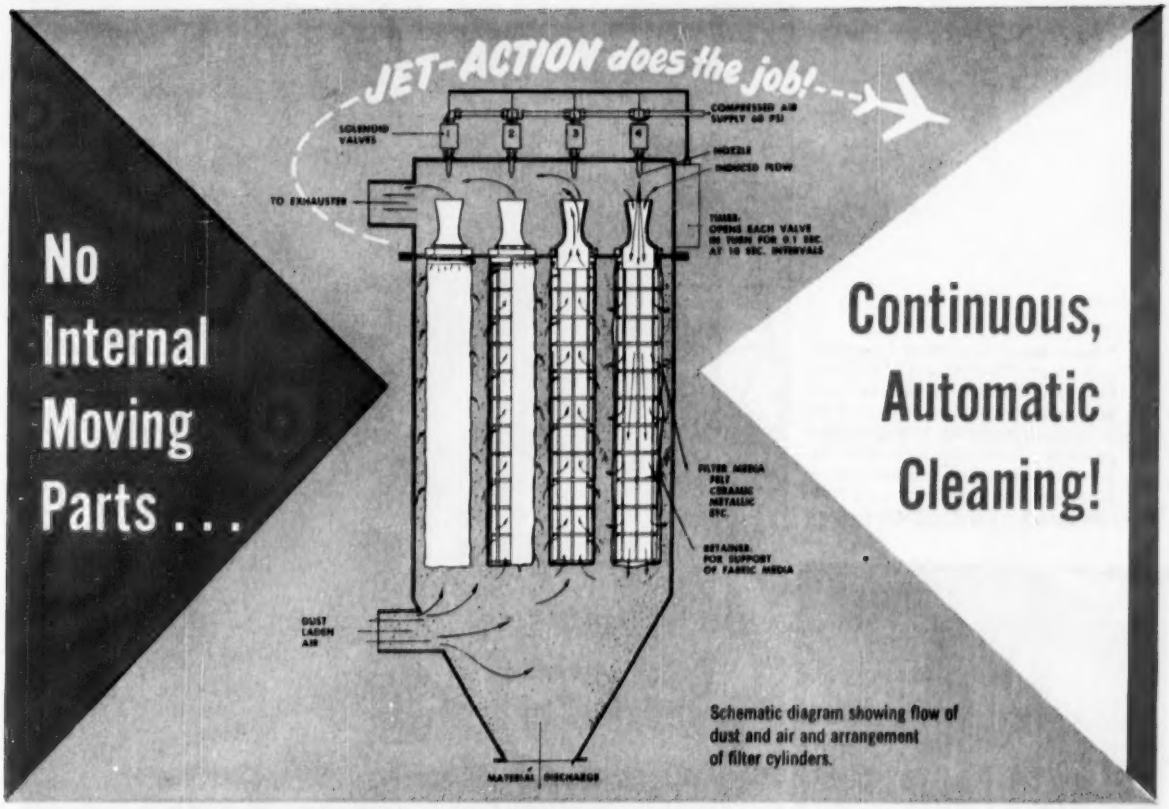
Wellington Sears

FIRST in Fabrics for Industry

Wellington Sears Company, 65 Worth Street, New York 13, N. Y.

WEST POINT TEXTILES

Offices in: Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis



Schematic diagram showing flow of dust and air and arrangement of filter cylinders.

The MIKRO-PULSAIRE* COLLECTOR



Model 48-6 MIKRO-PULSAIRE Collector—340 sq. ft. of filter area—capacities 2000-5000 cfm. A complete line of units for all collection jobs.

There are *no internal moving parts* in this radically new *jet-action* MIKRO-PULSAIRE Collector! Cleaning mechanisms with their gears, cams, chains and hoses have been entirely eliminated . . . maintenance costs are drastically reduced . . . process interruptions are avoided! This completely simplified unit is the first collector to offer *continuous automatic cleaning* with no moving parts — *true economy in operation*, at highest filtering efficiency . . . *99.9% plus!* You'll find full details, performance data, etc., in MIKRO-PULSAIRE Bulletin 52A. It's yours for the asking.

We'll be glad to have the Mikro Man call to show you and your plant engineers the tremendous advantages of MIKRO-PULSAIRE.

YOU GET ALL THESE FEATURES WITH THE NEW MIKRO-PULSAIRE!

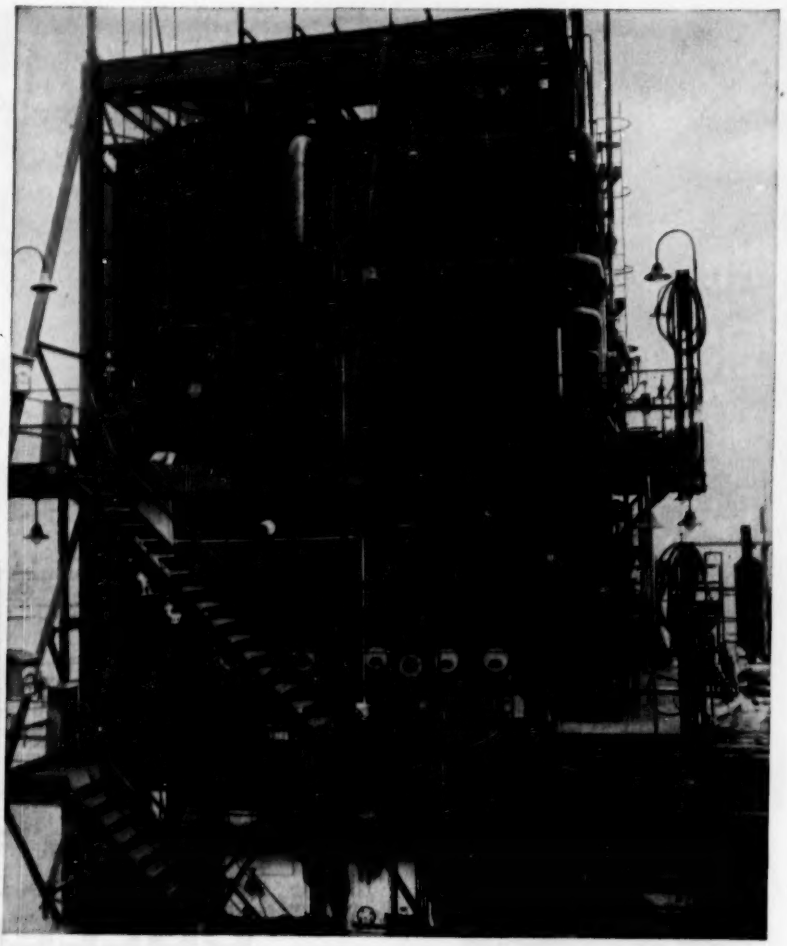
- **No internal moving parts**
- **Continuous, automatic cleaning**
- **Ease and simplicity of maintenance**
- **No shaking or frictional action on filter**
- **Low power requirements**
- **Efficiency—99.9%+**
- **Operating temperature limited by available filter fabrics only**
- **No primary mechanical collector required**
- **Inherently suitable for special conditions**
- **High filter ratio**

* patents applied for

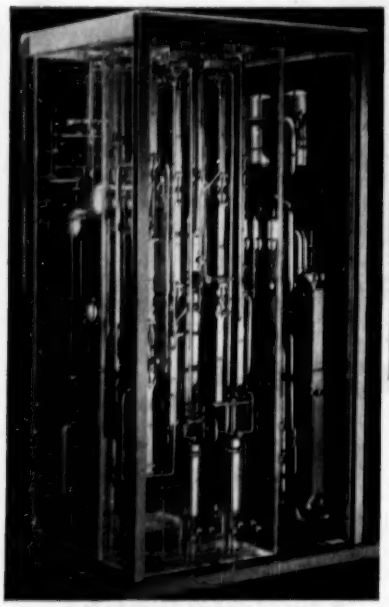
Mikro-D

PULVERIZING MACHINERY DIVISION
METALS DISINTEGRATING COMPANY, INC.
55 Chatham Rd. Summit, New Jersey

MANUFACTURERS OF PULVERIZING, AIR CONVEYING AND DUST COLLECTION EQUIPMENT



"Cold Box" is part of an ammonia plant. The Atlantic Refining Company built it to use the once-burned hydrogen by-product of the catalytic reforming of high octane gasoline. Here the hydrogen by-product is purified and nitrogen is recovered by liquefying and fractionating air from the atmosphere.



Model of Plant shows maze of stainless steel pipes and pressure vessels used for nitrogen separation and hydrogen washing. Actual plant was built by Hydrocarbon Research Inc., N. Y., with a capacity of 100 tons of anhydrous ammonia per day.

Another important job for nickel-containing Stainless Steel because...

The Problem: —325°F

This "cold-box" separates nitrogen from the air and purifies hydrogen. It's a step in the production of anhydrous ammonia at The Atlantic Refining Company's South Philadelphia plant.

Here, the temperature dips as low as *minus* 325°F. Much of the equipment operates at *minus* 140°F.

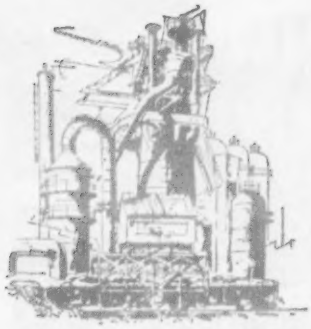
At those temperatures carbon steel is as brittle as glass. You can see why equipment has to be made of special material. And it is.

Designers of the plant knew that a safe and practical material to use for much of the equipment was austenitic chromium-nickel stainless steel.

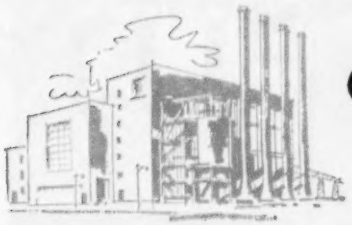
With 8% nickel, stainless steel has the ability to retain toughness and ductility right down to as close as we can get to absolute zero. And 18-8 stainless steel has the necessary strength to handle the relatively high (100 to 440 psi) operating pressures.

Do you have a low temperature problem? If so, you'll find "Properties of Stainless Steel at Low Temperatures" extremely helpful. And Inco's Development and Research Division is ready to help you.

INCO TRADE MARK THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

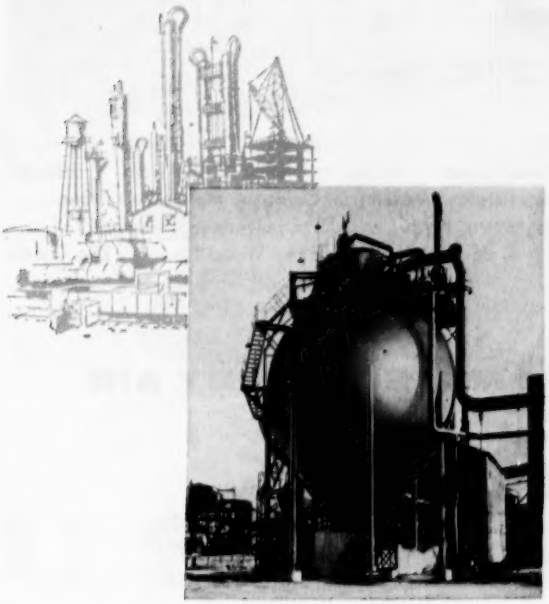


First in water conditioning



Cochrane HOT PROCESS

AT U.S. STEEL'S CLAIRTON PLANT



Designed to soften and deaerate 100,000 GPH of boiler feed water, this Cochrane unit at U.S. Steel's plant is a sludge blanket design deaerating type Hot Process Softener with a 38' dia. spherical top sedimentation tank. The Softener is followed by six 11' dia. anthracite filters equipped with surface washers.

Cochrane pioneered the versatile Hot Process Softener. Its flexibility and efficiency are unquestioned and it provides a water softening process that can handle both turbid surface supplies and clear well waters.

Cochrane Hot Process Softeners can be used to reduce silica economically and effectively. It is also possible to provide integral deaeration elements for condensate and treated makeup where required.

For medium and high pressure boilers, Hot Process can be followed by Hot Zeolite to provide zero hardness and lower solids as well as to reduce CO_2 in the steam.

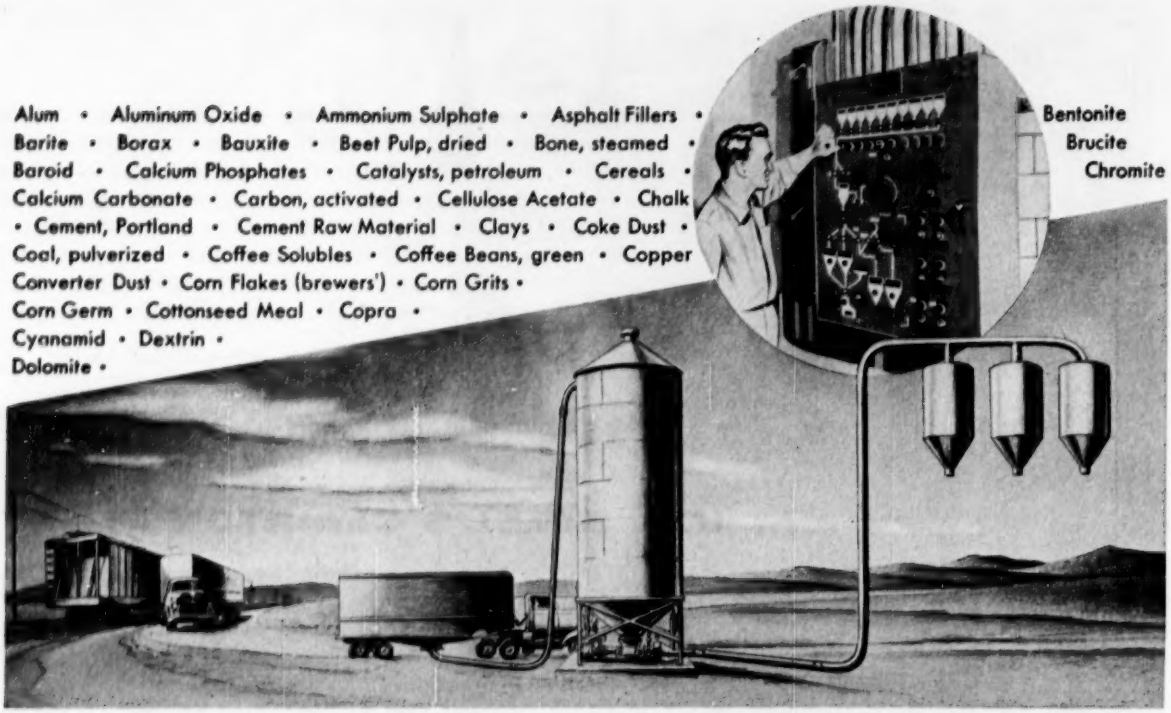
If you now have a Hot Process Softener, Cochrane Hot Zeolite may be readily added, assuring higher effluent quality at lower treating cost.

Cochrane, first in water conditioning for over half a century, continues to lead the way in Hot Process and Hot Zeolite. Call our engineers for the answer to your problem. Ask for Publication 4801.

Cochrane
CORPORATION
3113 N. 17TH STREET, PHILADELPHIA 32, PENNA.
NEW YORK • PHILADELPHIA • CHICAGO
Cochrane Water Conditioning Ltd., Toronto 4; Montreal 1, Canada
Representatives in 30 principal cities in U.S.; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii; Manila, Philippine Islands.
Pottstown Metal Prods. Div.—Custom built carbon steel and alloy products.

COCHRANE CORPORATION · WATER CONDITIONING ENGINEERS SINCE 1863 · PHILADELPHIA

Demineralizers • Zeolite Softeners • Hot Process Softeners • Hot Lime Zeolite Softeners • Dealkalizers • Reactors • Deaerators • Pressure Filters
Continuous Blowoff Systems • Condensate Return Systems • Steam Specialties



Alum • Aluminum Oxide • Ammonium Sulphate • Asphalt Fillers • Barite • Borax • Bauxite • Beet Pulp, dried • Bone, steamed • Baroid • Calcium Phosphates • Catalysts, petroleum • Cereals • Calcium Carbonate • Carbon, activated • Cellulose Acetate • Chalk • Cement, Portland • Cement Raw Material • Clays • Coke Dust • Coal, pulverized • Coffee Solubles • Coffee Beans, green • Copper Converter Dust • Corn Flakes (brewers') • Corn Grits • Corn Germ • Cottonseed Meal • Copra • Cyanamid • Dextrin • Dolomite •

Bentonite
Brucite
Chromite

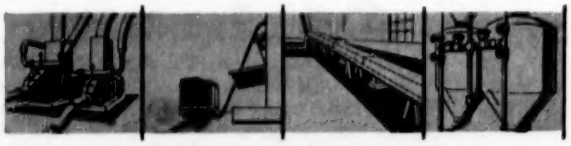
Diatomaceous Earth • Feed Ingredients • Feeds, soft • Feldspar • Fertilizers • Flaxseed • Flue Dusts • Fluorspar Flour • Fly Ash • Fuller's Earth • Gluten Meal • Gypsum (raw or calcined) • Grains • Ilmenite • Iron Salts • Litharge Lime, pebble • Lime, hydrated • Limestone, pulverized • Magnesite • Magnesium Oxide • Manganese Dioxide • Milk, dried • Nylon Pellets • Phosphate Rock, pulverized • Polyethylene • Pyrites • Quartz, pulverized • Rubber Pellets • Resins, synthetic • Salt Cake • Shells, pulverized • Semolina • Talc • Wood Chips • Wood Flour • Zinc Oxide

CONVEY MANY DRY BULK MATERIALS BY AIR

Automatically

Conveying of dry bulk materials can be accomplished automatically—by air—with Fuller systems. Dollar losses, formerly conceded to be "natural" incidents of conveying, are now being chalked up as new savings. Fuller systems are designed for minimum maintenance . . . completely enclosed for sanitary transportation from carrier to storage to process without spillage. Installation is possible anywhere pipelines can be run without changing plant structures or interrupting production.

If you use dry bulk materials, investigate the possibilities of profiting with Fuller. Write for Bulletin G-2, "How to Pull Dollars Out of Thin Air."



FULLER COMPANY
134 Bridge St., Catasauqua, Pa.
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
Chicago • San Francisco • Los Angeles • Seattle • Kansas City • Birmingham

Fuller
pioneers in harnessing Air

G-139
3676

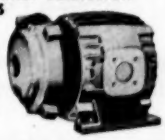
rough CONDITIONS?



TYPE **J**
1 TO 30 H. P.
Rerated Frames
182 to 326U

U.S. TOTALLY-ENCLOSED MOTORS

Protected **AGAINST CORROSION ALL EXPOSED PARTS CAST IRON...**



Rust-resistant solid cast iron withstands abuse, wear and corrosion. *Protects* working parts!

Protected **BY LUBRIFLUSH FOR LONGER BEARING LIFE**



New grease forces old grease out—keeps bearings fully lubricated. *Protects* bearing efficiency!

Protected **AGAINST INTERNAL HEAT WITH ASBESTOS WINDINGS**



Nature's greatest heat resistor, asbestos can't carbonize! *Protects* windings against heat!

Protected **FROM STRESS AND WARP BY NORMALIZING CASTINGS...**



All cast-iron components are heat-seasoned to stabilize molecular structure. *Protected* against warp!

Total Protection in every direction

Large savings are being gained by many industries using *enclosed* motors in place of the usual "open" or ordinary protected motor. U.S. Totally Enclosed gives *total* protection in every direction—from corrosion, dusts, abrasives, impact, weather, spray and splash! This means motor dependability ... long life ... savings both on motor costs and production continuity!

MAIL COUPON NOW ▼

U.S. *Electrical* MOTORS

U.S. MOTORS

U.S. ELECTRICAL MOTORS, Inc. CE-9
Los Angeles 54, Calif.—Box 2058, Milford, Conn.

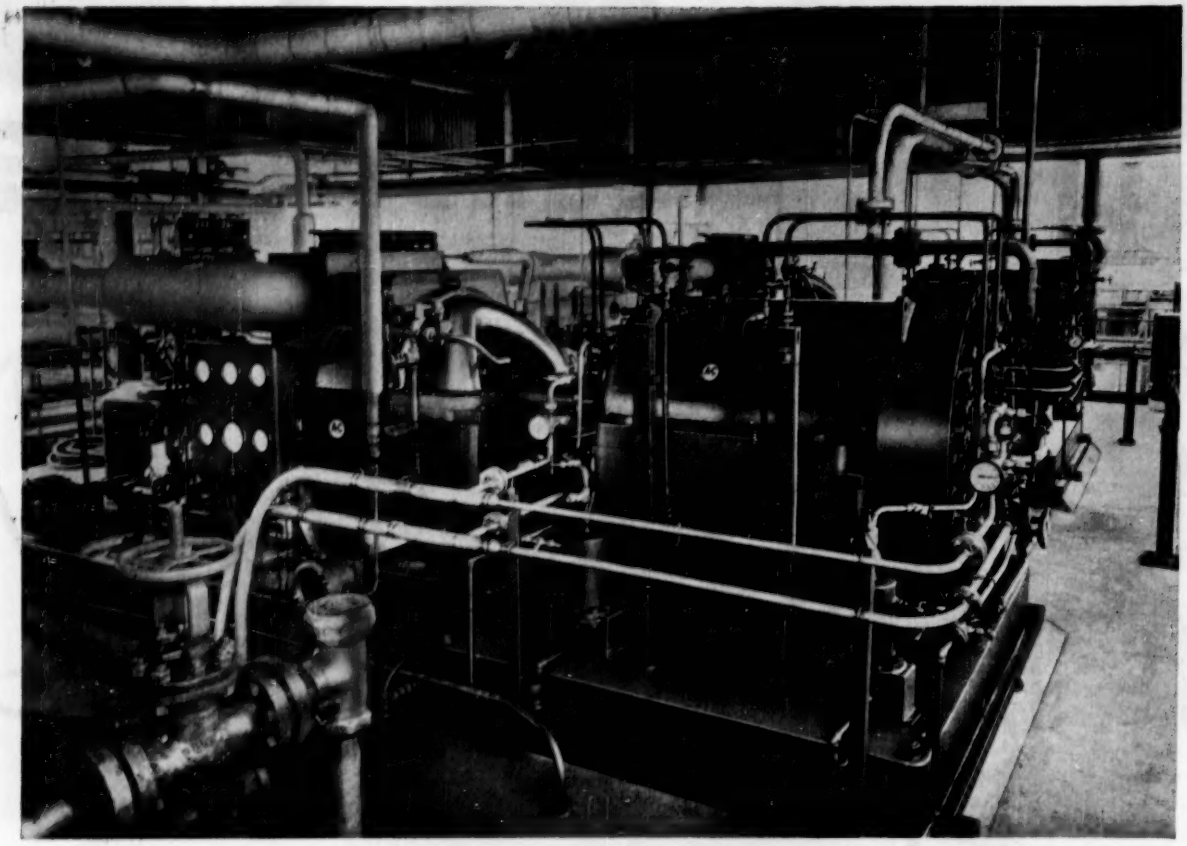
Gentlemen: Please send me complete information in your Totally-Enclosed Motors.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____



Engineered and constructed by The M. W. Kellogg Company.

Gulf Refinery Uses Allis-Chalmers Compressors for Hydrogen Recycling

Two high pressure compressors of the latest Allis-Chalmers barrel-type design are in use at the Gulf Oil Corporation Plant at Port Arthur, Texas.

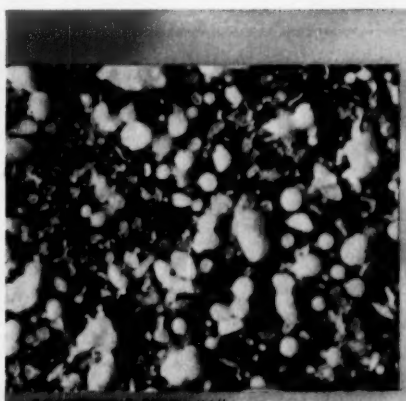
These units are used in a desulphurization process, in the refining of fuel oil. They are typical of Allis-Chalmers units chosen for upgrading processes.

Allis-Chalmers builds centrifugal, axial, and rotary sliding-vane type compressors for all refinery applications. Contact your nearby A-C office for information about your requirements, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

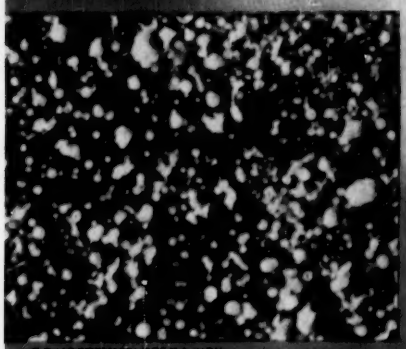
A-C ALLIS-CHALMERS

ALLIS-CHALMERS

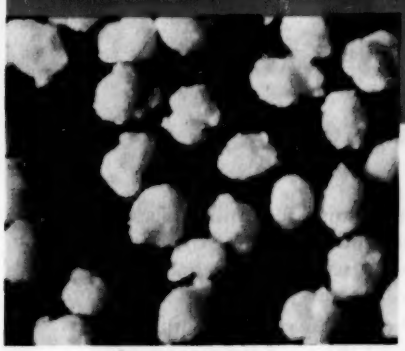
A-5421



COMPETITIVE RESIN "A"



COMPETITIVE RESIN "B"



ESCAMBIA PVC RESIN

no "dust storms" with ESCAMBIA PVC

Photomicrographs* of production samples of leading PVC resins show that Escambia PVC resins are extremely low in fines and have superior uniformity of particle size.

Besides eliminating "dust storms" in your plant, these qualities in Escambia PVC give you freer-flowing hot pre-mixes, lower "fish eye" count, better heat stability, and improved color uniformity and clarity.

Prove these unique advantages in your own plant with a test run of Escambia PVC resin best suited for your operation:

ESCAMBIA PVC 1250 — High molecular weight recommended for extrusion and calendered film.

ESCAMBIA PVC 1225 — Intermediate molecular weight and particularly adapted for supported and unsupported sheeting.

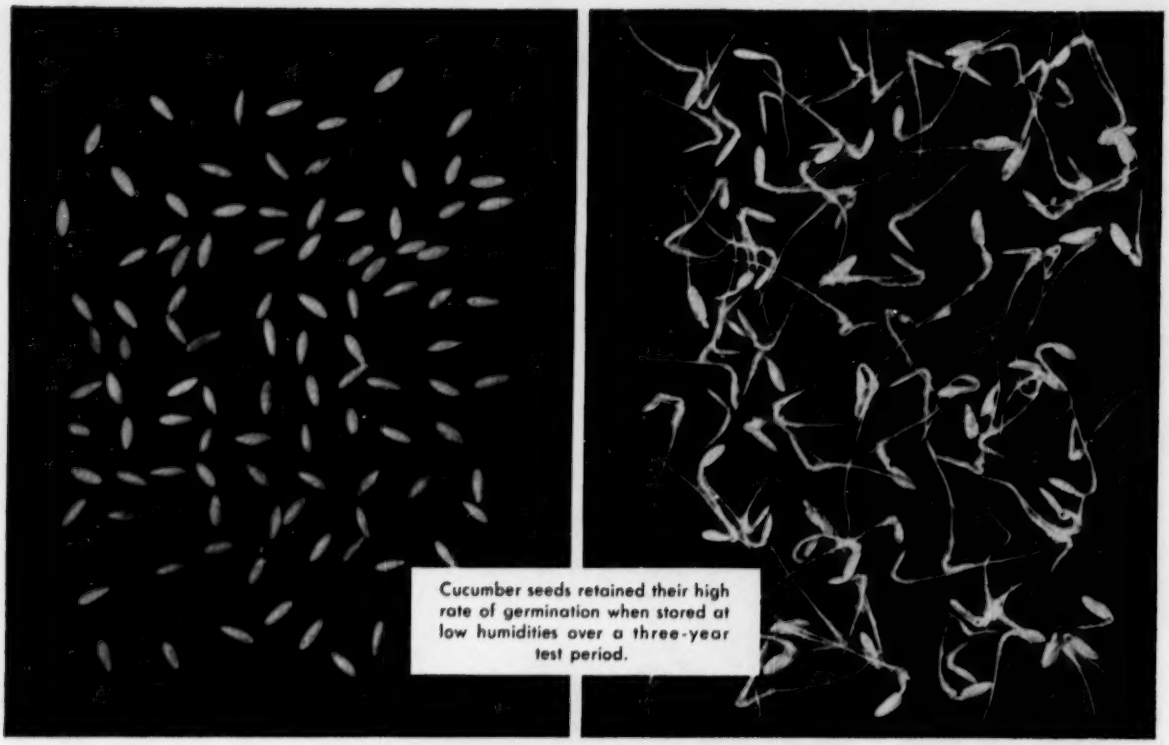
ESCAMBIA PVC 1200 — Recommended for applications in which processing temperatures require the use of a lower molecular weight resin than PVC 1225.

*In the photomicrographs shown above, the resins have been magnified 40 times.

For additional information about Escambia's straight PVC resins — write or call —

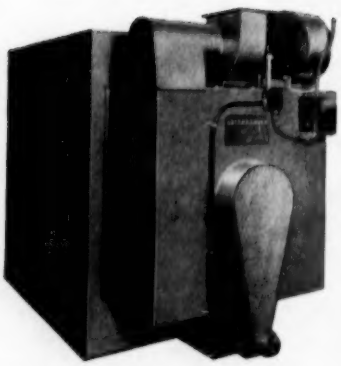
ESCAMBIA CHEMICAL CORPORATION

261 MADISON AVENUE • NEW YORK 16, N. Y.



Cucumber seeds retained their high rate of germination when stored at low humidities over a three-year test period.

Seeds stored in DRY rooms stay vigorously alive



CH Lectrodryers keep storage areas DRY.

VEGETABLE SEEDS pick up moisture rapidly if stored in a humid atmosphere. And the higher their moisture content, the more rapidly seeds lose their capacity to germinate and grow into healthy plants.

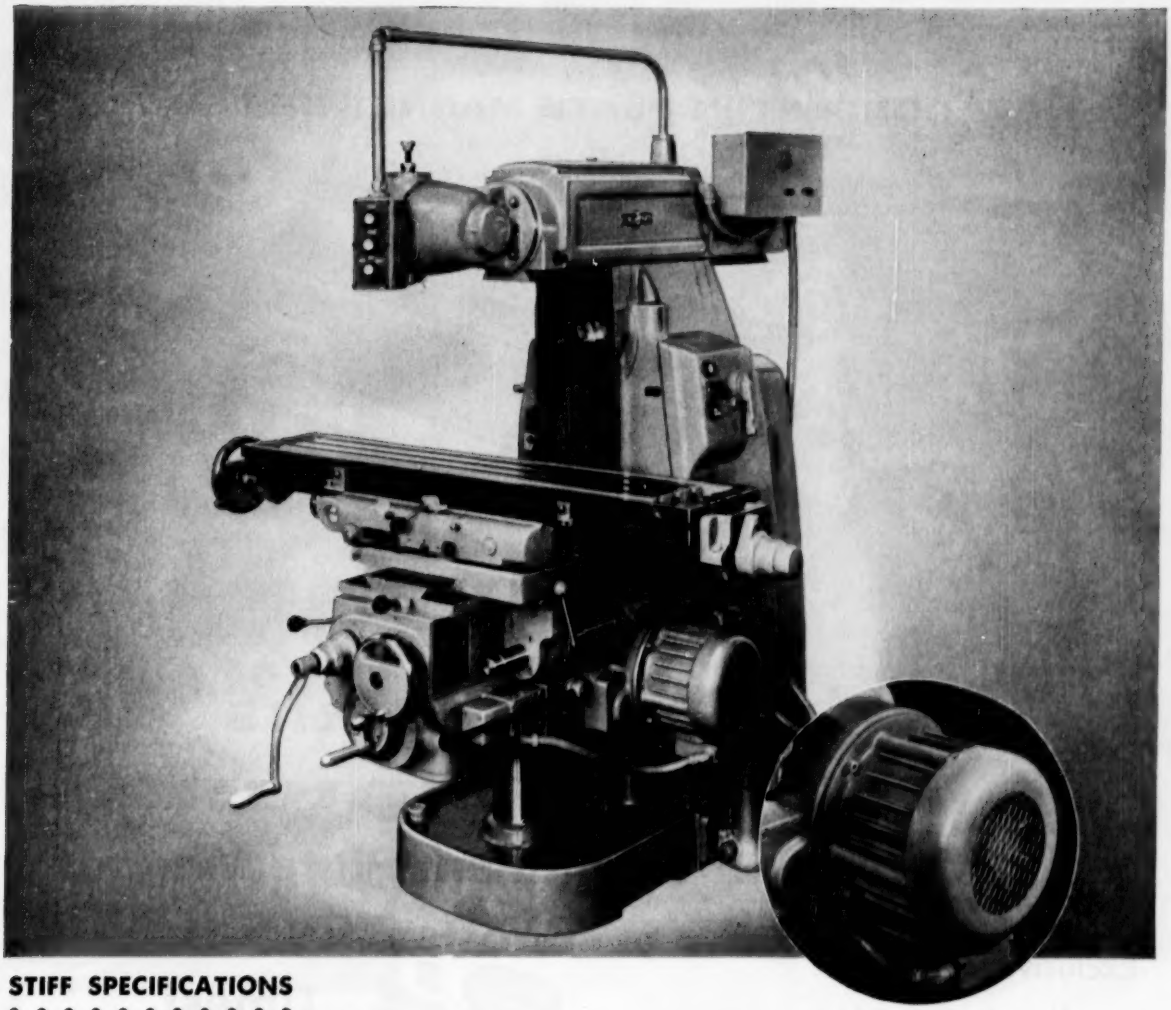
As long ago as 1937, The Kilgore Seed Company of Plant City, Florida, recognized the need for maintaining DRYness in seed storage rooms. Today a Type CHK Lectrodryer* is used to obtain and maintain any selected per cent of relative humidity which is desired in the seed storage room.

Refrigeration as a means of lowering humidity is not satisfactory here, since seeds sweat when brought out of storage. Thus DRYing with Lectrodryers provides added protection, avoiding sweating.

Because Moisture Isn't Pink shows how others are safeguarding materials and processes with Lectrodryers. For a copy, write Pittsburgh Lectrodryer Division, McGraw-Edison Company, 303 32nd Street, Pittsburgh 30, Pa.

Lectrodryer

*REGISTERED TRADEMARK U. S. PAT. OFF.



STIFF SPECIFICATIONS

Yet a DIEHL motor met all requirements

The requirements of one of the largest milling machine manufacturers called for a close-coupled, special duty motor to raise and lower the knee and develop sufficient torque for heavy table loads in rapid traverse without stalling. Cool operation was imperative to avoid distortion of the machine table due to heat transfer. The motor was to be mounted directly on the gear case, therefore complete protection against oil leakage into the motor was essential. Motor size, compactness and appearance were important factors. DIEHL developed the special totally enclosed motor illustrated, which met all desired requirements. Cool operation was assured by the fan-cooled design of the motor, effectively preventing heat transfer. The flat-type construction saved considerable space and overhang, conforming well with machine contours. Positive and dependable machine operation was the end result.

This is another example of DIEHL accomplishment based on almost three-quarters of a century of experience in the design and manufacture of motors for industry. Utilize this experience in the solution of your motor problems. We'll work closely with you to provide the right motor — at the right time — at the right price.

Diehl

DIEHL MANUFACTURING COMPANY
Electrical Division of
THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

☐ Please send me Consolidated Motor Catalog and Price List No. CE-5—3540

☐ Please have a DIEHL representative call

NAME _____

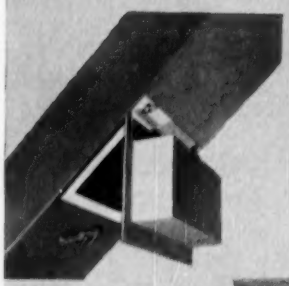
COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

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A NEW CONCEPT IN PLATE MAGNET DESIGN...



MAGMAN installed in inclined chute



Stearns MAGMAN plate magnet



MAGMAN hump magnet assembly

STEARNS Magman



Permanent Plate Magnet Boosts Efficiency 2½ Times!

Exclusive OFFSET magnetic air gap stops dangerous tramp iron ordinary plate magnets can't hold!

The secret of the amazing holding ability of the Stearns *Magman* is simple. Unlike ordinary plate magnets, the *Magman* employs an exclusive offset air gap feature that concentrates magnetic force right at the first pole piece. Tramp iron has no chance to speed up as it approaches the magnet face.

Does it work? Size for size, the Stearns *Magman* provides 2½ times the separating efficiency of any other unit — performance that makes ordinary plate magnets obsolete!

51



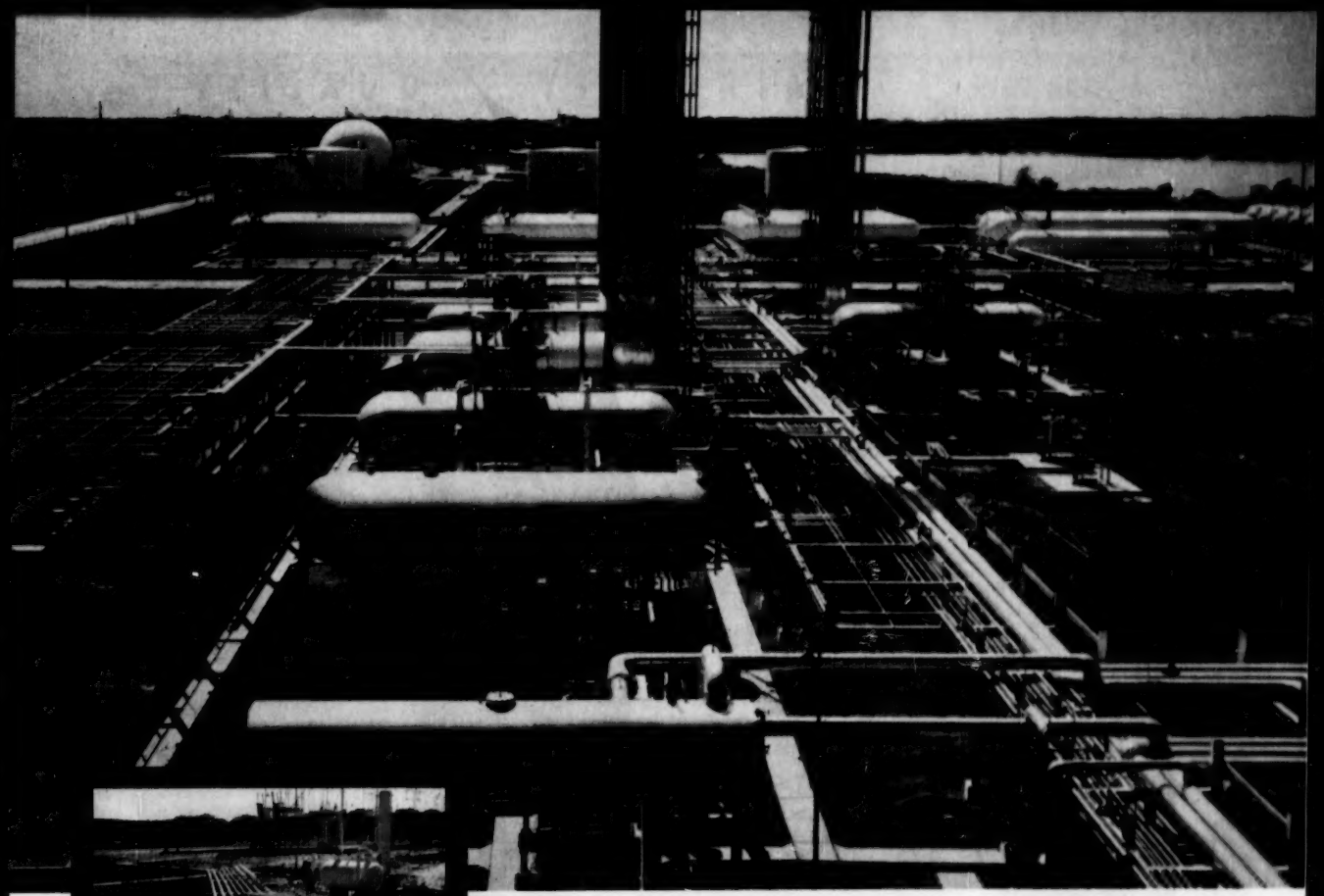
FREE BOOKLET HELPS YOU SELECT YOUR OWN MAGMAN

If your process involves handling flowing material in chutes, spouts, ducts or on conveyors, you'll want to know more about Stearns *Magman*. Write today for new, free booklet that gives complete details on construction features and performance, provides an easy method of choosing the right *Magman* for your plant. Ask for Bulletin No. 1071.

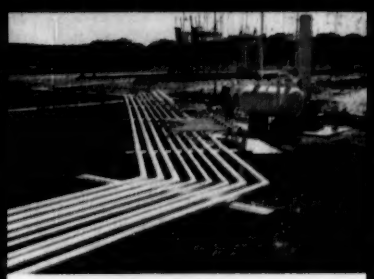


STEARNS MAGNETIC PRODUCTS

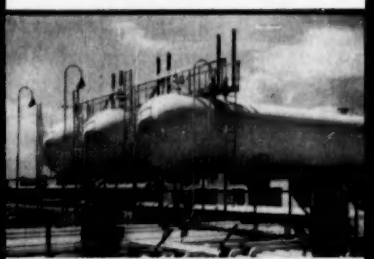
635 South 28th Street • Milwaukee 46, Wisconsin



Three-coat systems of Normal Copon self-cleaning white tank coating and three-coat systems of Normal Copon aluminum tank finish were used to protect this fractionating plant of The Bay Petroleum Corp. (a subsidiary of Tennessee Gas Transmission Co.).



Copon pipe coatings provide thicker films per coat for extra protection of seams, welds, sharp edges and other trouble spots.



Copon tank coatings remain tough and elastic when subjected to heat, high humidity and chemical fumes.

tanks stay whiter, brighter... protected by Copon coatings

Coatings of Normal Copon provide superior protection for tanks, pipes, and miscellaneous plant equipment. They cling tenaciously to metal surfaces, withstand the expansion and contraction of metal, and provide longer-lasting film integrity to assure permanent corrosion protection. Expensive surface preparation is not required when Copon-protected tanks are repainted,,and Copon Coatings have the slowest rate of erosion in the industry.

Copon®

FOR CORROSION CONTROL

For complete information on Copon, write on your company letterhead to the manufacturer located nearest your city.

BENNETT'S.
65 W. First South St., Salt Lake City 10, Utah

WALTER N. BOYSEN CO.
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2309 E. 15th St., Los Angeles, Calif.

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McDOUGALL-BUTLER CO., INC.
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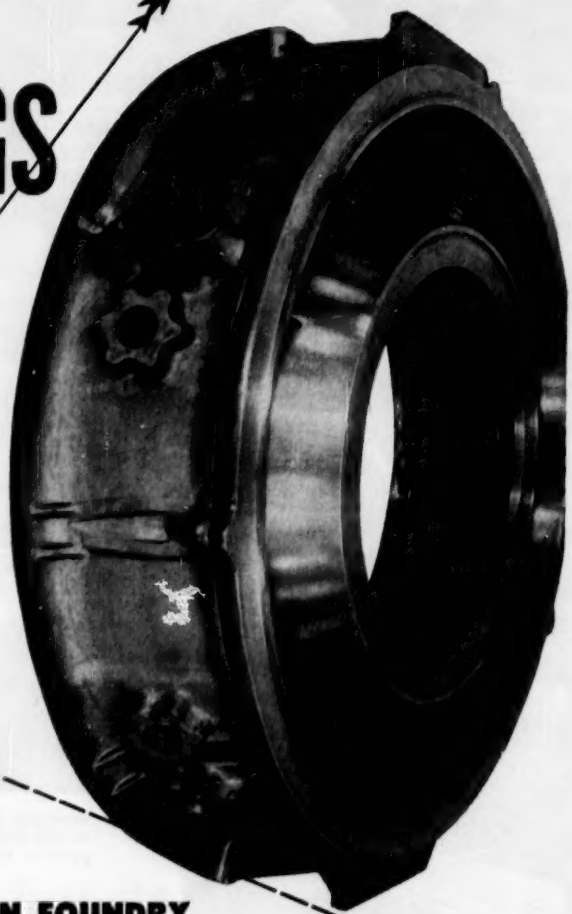
JAMES B. SIPE and COMPANY, INC.
P. O. Box 8010, Pittsburgh 16, Pa.

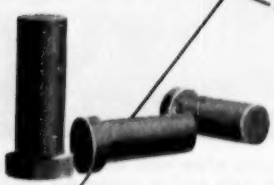
COAST PAINT & LACQUER De MEXICO, S.A.
Apartado Postal No. 9637, Mexico, D.F.

AIRCRAFT QUALITY

ALLOY CASTINGS

...for the special requirements of your industry





METALS PROCESSING DIVISION FOUNDRY handles wide range of sizes, closely controls dimensions



Precision testing methods provide close control of casting quality

Curtiss-Wright's Metals Processing Division today offers your industry precision castings of critical parts in a wide variety of sizes, and with closely controlled dimensions. For example, in the large casting shown, tolerance is ±.030 over 36″ diameter. From its modern, completely equipped foundry in Buffalo, the Division supplies heat, corrosion and abrasion resistant castings from a full range of special-property alloys, including ductile iron... by sand, centrifugal, ceramic or shell processes.

Precision alloying techniques, modern melting controls with spectrometer testing, X-ray control by experienced radiographers — all add up to castings with superior physical and mechanical properties . . . mean better and more dependable products for the critical needs of industry. Qualified design engineering assistance is a part of the comprehensive Metals Processing Division service. Write for details.

75 GRIDER ST.

METALS PROCESSING DIVISION
CURTISS-WRIGHT
CORPORATION • BUFFALO, N. Y.

Metals Processing Division Branch Offices: New York • Houston • Los Angeles

Controlled dispersion for better blends

If you're coating a fine, dry material; blending liquids into a dry powder . . . or dispersing a small amount of one material into another you need more than a simple stirring, tumbling or agitating action to achieve the desired results.

In the Simpson Mix-Muller a *three-way* kneading, smearing, spatulate action actually coats one material with another—rather than placing them *next* to each other. Agglomerates are broken up, moisture or binder dispersion is thorough. You get an intensive, homogenous mix that *stays* mixed and will not segregate in storage or transit. Want proof? Write for details on a confidential test. See what *mulling* can do and remember . . .



MIXING IS OUR BUSINESS

SIMPSON *MIX-MULLER*® DIVISION

National Engineering Company
636 Machinery Hall Building • Chicago, Illinois

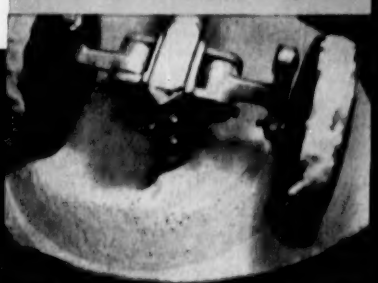
3 WAY ACTION saves time and reprocessing



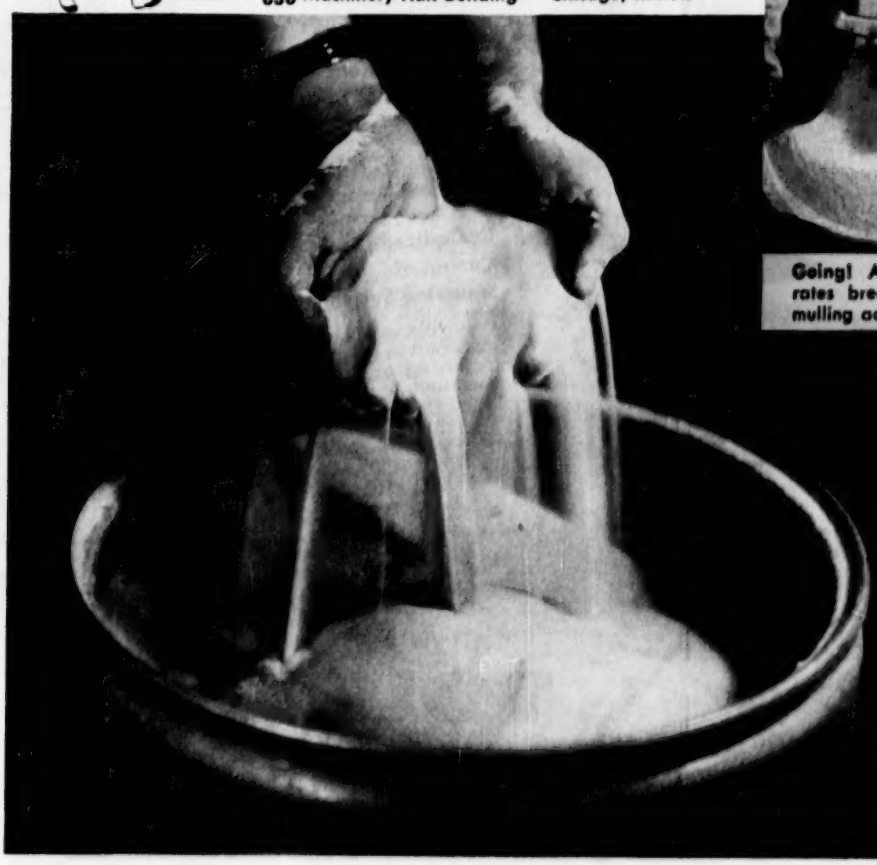
Mix is wetted; dispersion of coating media begins.



As mulling proceeds, mix begins to "lump" up as moisture is dissipated.



Going! As material drys agglomerates break down under intensive mulling action.



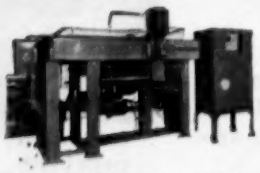
◀ Gone! Components are thoroughly blended. Mix is uniform, smooth flowing . . . quickly achieved.



WRITE FOR Bulletin on *Mulling for the Chemical and Process Industry.*

YOUR ANSWER TO A PRODUCTION OR CONTROL PROBLEM MAY BE A *Custom-Engineered* TOLEDO

Product Testing and Sorting



This custom-engineered Toledo automatically tests and classifies coil springs for automobiles at the rate of 900 per hour. It is one of many types of Toledos used in classifying, testing and balancing.

Automatic Bulk Weighing



Accurate, printed weight records of bulk materials such as flour going into truck or carload shipments are provided by this Toledo. Automatically weighs materials and transmits weight data to remotely located adding machine for totalizing and recording.

Automatic Liquid Filling



This Toledo provides fast sub-surface filling of drums, eliminates frothing—cuts off flow of liquid precisely and automatically. Speeds liquid handling operation. Indicates tare, gross and net weight.

Electronic Weighing with Remote Dial Location



Toledos with electronic load cells eliminate mechanical connections between platform and scale head; bring new flexibility to testing and weighing operations. Dial may be located wherever desired and weight data fed into a variety of recorders and office machines for processing. Digital indication, if desired.

Centralized Control of Weighing Systems



Complete, centralized, push-button control of batching or filling operations is provided by Toledo Control Consoles such as this. Listing and adding unit receives weight data directly from remote scales.

What's your problem?

Whether the answer lies in a custom-engineered Toledo unit, a special adaptation or in one of the wide selection of standard Toledos, your inquiry will receive prompt attention. Write today. Toledo Scale Company, Toledo 13, Ohio.

TOLEDO®

HEADQUARTERS FOR SCALES

SERVICE Factory-Trained 500 Cities


FLOOR AND TRUCK SCALES


BENCH AND PORTABLE SCALES


OVER-UNDER SCALES


WEIGHT PRINTING


OVERHEAD TRACK SCALES


COUNTING SCALES

Send for your sample

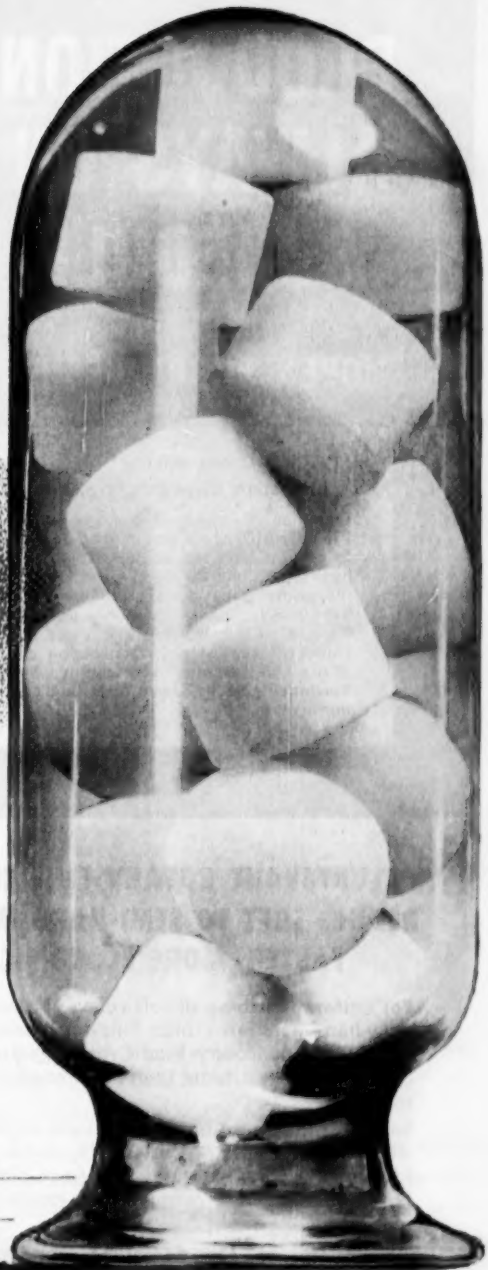
and see why

National

MALEIC ANHYDRIDE TABLETS

are so

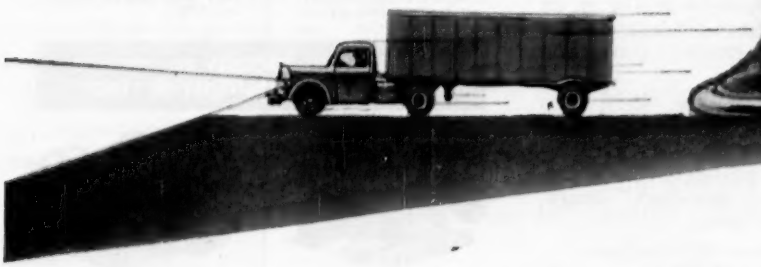
economical and easy to use!



As the principal producer, National Aniline's fully-integrated volume output and fast deliveries from our strategically-located Moundsville plant expedites your production and minimizes your inventory.

And because the quick-dissolving, uniform round tablets resist degradation in handling, they are essentially non-dusting and give you fewer fines.

We will be happy to send you a sample of this high-quality, versatile intermediate. Write to the nearest National Aniline office.



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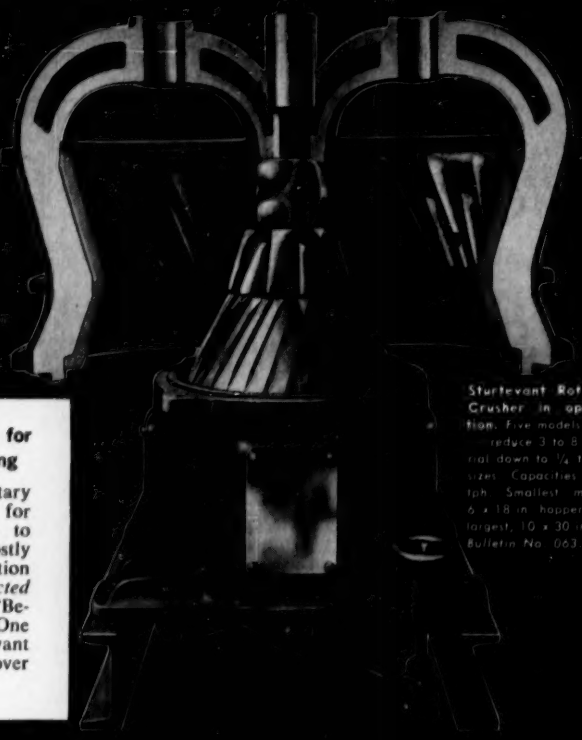
Akron Atlanta Boston Charlotte Chattanooga Chicago Columbus, Ga. Greensboro
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Allied Chemical

PRODUCTION ALWAYS ON SCHEDULE

Thanks to

"OPEN-DOOR" DESIGN



Sturtevant Rotary Fine Crusher in open position. Five models available — reduce 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening, largest, 10 x 30 in. Request Bulletin No. 063.

"One Man, One Minute" Accessibility for Inspection, Clean-outs, Trouble-shooting

One man can swing open a Sturtevant Rotary Fine Crusher in a matter of minutes — for inspection and maintenance — thanks to Sturtevant's unique "Open-Door" design. Costly downtime is cut to a minimum, production kept on schedule — *even when the unexpected happens.* Little wonder that users say: "Because of their rugged construction and "One Man, One Minute" accessibility, Sturtevant machines give us *lower* operating costs over *more* years."

STURTEVANT ROTARY FINE CRUSHERS REDUCE SOFT TO SEMI-HARD MATERIALS FASTER, MORE ECONOMICALLY

For uniform crushing of soft (clay, charcoal) to moderately hard materials (softer limestone, cement clinkers), the Sturtevant Rotary Fine Crusher is practically non-clogging — much faster than other machines, less costly to operate.

Smooth production flow. The single turning of a hand wheel regulates the output size (from ¼ to 1¼ in. on largest model) — provides a uniform product, dustless operation, steady output for greatest production efficiency.

A lifetime of low-downtime service. Built into Sturtevant Rotary Fine Crushers is Sturtevant's 83 years of successful engineering of dry processing units and equipment. Rugged construction, plus easy accessibility provided by Sturtevant's unique "Open-Door" design, assures more output per machine year.

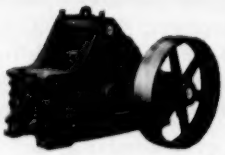
Write today, Address: Sturtevant Mill Company, 100, Clayton St., Boston 22, Mass.

STURTEVANT

Dry Processing Equipment

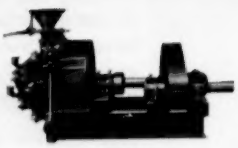
The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS



JAW CRUSHERS

Reduce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smaller sizes operate on double cam principle—crush twice per energy unit. *Request Bulletin No. 062.*



RING ROLL MILLS

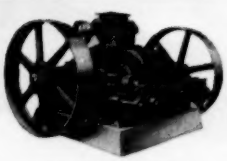
Reduce hard or soft 1½ in. and smaller material to from 6 to 200 mesh. Grind only — no screens. Capacities of 3 models range up to 18 tph, depending on model and material. Ring diameters and faces 24 x 7 in.; 45 x 8 in.; 44 x 14 in. *Request Bulletin No. 079.*

ALL STURTEVANT MACHINES ARE DESIGNED TO OPERATE ADVANTAGEOUSLY IN "UNITS"



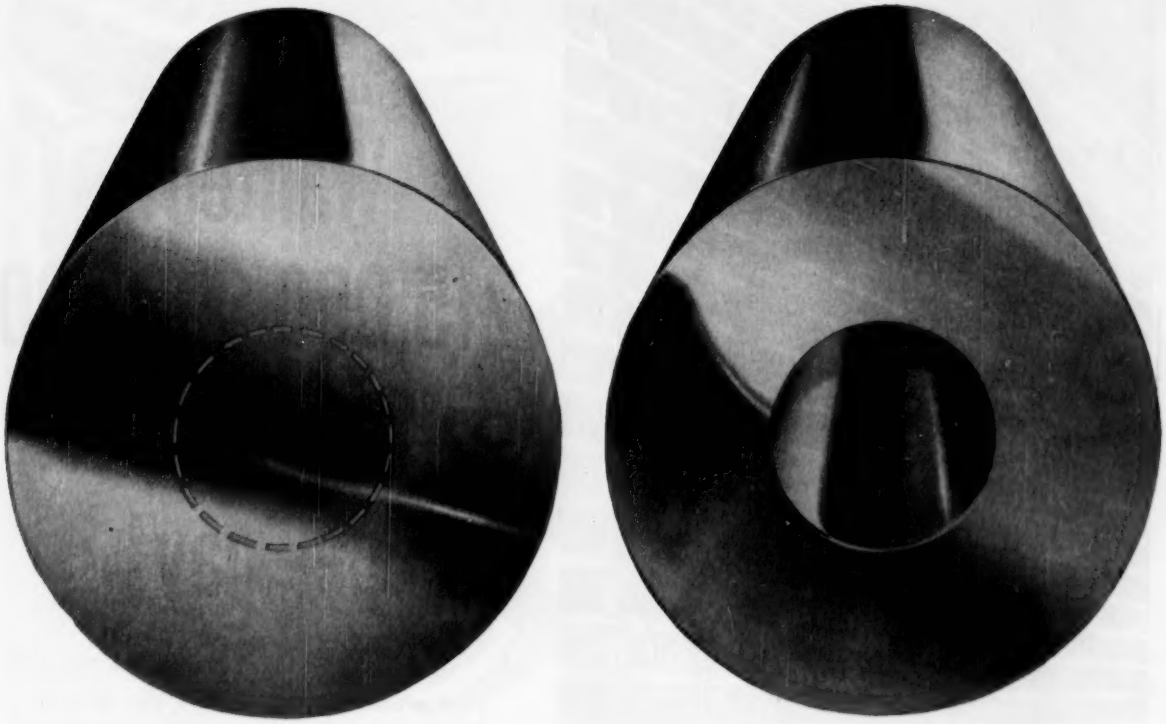
HAMMER MILLS

Reduce to 20 mesh. Swing-Sledge Mills crush moderately hard material up to 70 tph. Hinged-Hammer Pulverizers crush softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*



CRUSHING ROLLS

Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls for automatic adjustment in operation; Plain Balanced Rolls; Laboratory Rolls. Recomended for 3 to 1 reduction. *Request Bulletin No. 065.*



WHY BORE OUT BAR STOCK...

use TIMKEN® heavy wall seamless pressure tubing for high temperature applications

IF you've been boring out forgings or bar stock to get the wall thickness you need to withstand higher operating pressures in refineries, steam plants or chemical plants, Timken® seamless steel tubing can save you money. The hole's already there. And you can get the wall thickness you need.

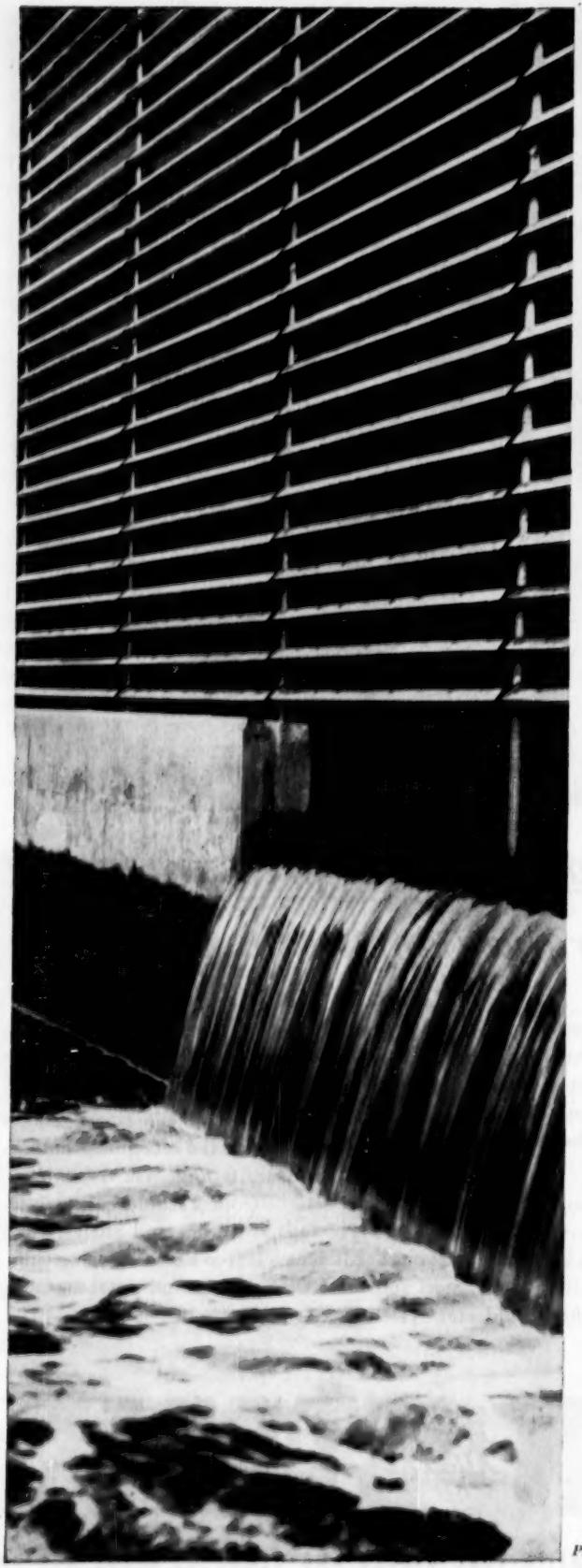
Timken seamless steel tubing is ideally suited to today's higher operating pressures. The piercing process we use gives it a fine forged quality. It also imparts a spiral grain flow for greater strength, a refined grain structure that brings out the best in the metal. And the quality you get is uniform from bar to bar, heat to heat, tube to tube. It's electric furnace fine alloy steel—quality controlled every step of the way.

Over 20 years of research and experience makes Timken Company metallurgists the recognized authorities on heavy wall pressure tubing. Ask the experts! Let them help you select—from 22 different analyses and sizes up to 11″ O.D.—the size and analysis best suited to your needs. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U. S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING



Wanted! 215,000,000,000 gallons of water per day!

Your process cooling towers may be doing a fulltime job now, but soon you'll have to work them overtime. By 1975, report authorities, industry *alone* will require 215,000,000,000 gallons of water per day!

To stand up to such intensive usage, towers should have the protection that only continuous L&N pH control automatically provides. L&N engineers treat each tower as an individual pH problem. Its control system is engineered on the basis of L&N's pH Controllability Analysis. This appraisal of the tower's "controllability factors" (flows, retentions, concentrations, etc.) tells us whether pH is actually controllable under existing tower conditions. If the answer is negative, the analysis highlights what must be done to *make* pH controllable.

The benefits of this unique L&N approach are significant. They include, in the words of an operator of two 200,000-gallon towers, ". . . conserving large amounts of make-up water, wood protection, prevention of carbonate scale, and more effective slime control." His report adds that "automatic pH control at both plants has been effective and satisfactory."

Write for Process Data Sheet 700(1), "L&N pH Control of Cooling Tower Water." You'll also receive our Controllability Analysis Questionnaire to complete and return, without obligation, for answers to your cooling tower pH problems. The address, Leeds & Northrup Co., 4916 Stenton Ave., Phila. 44, Pa.

LEEDS NORTHRUP
Instruments Automatic Controls • Furnaces

Photo courtesy J. F. Pritchard Co.



New flexible pipe covering reduces application costs

The great flexibility of Armstrong Armaflex® helps speed insulation of low and medium temperature lines – in many cases, substantially reduces costs compared with the cost of applying ordinary type coverings. Armaflex is slipped on pipe or tubing before connections are made; it follows contours readily. If pipe is in use, Armaflex is slit lengthwise, snapped on, and sealed with Armstrong 520 Adhesive. Airproof and waterproof, Armaflex needs no separate vapor barrier. Highly efficient on lines operating up to 200° F., Armaflex comes in 6′ lengths, ⅜″ and ½″ thicknesses, for pipes and tubing up to 3⅛″ o.d.

Armstrong Armaflex is one of the fine products in the full line of Armstrong Insulations. Armstrong also offers you a complete contracting service, geared to install these materials economically and efficiently.

Armstrong INSULATIONS

for temperatures from −300° F. to +2800° F.

*® ARMSTRONG CORK COMPANY. MANUFACTURED BY OWENS-CORNING FIBERGLAS CORP.

Free Booklets



Armstrong Armaflex, a Flexible Pipe Insulation

Armstrong Armaglas* Insulations (data sheets)

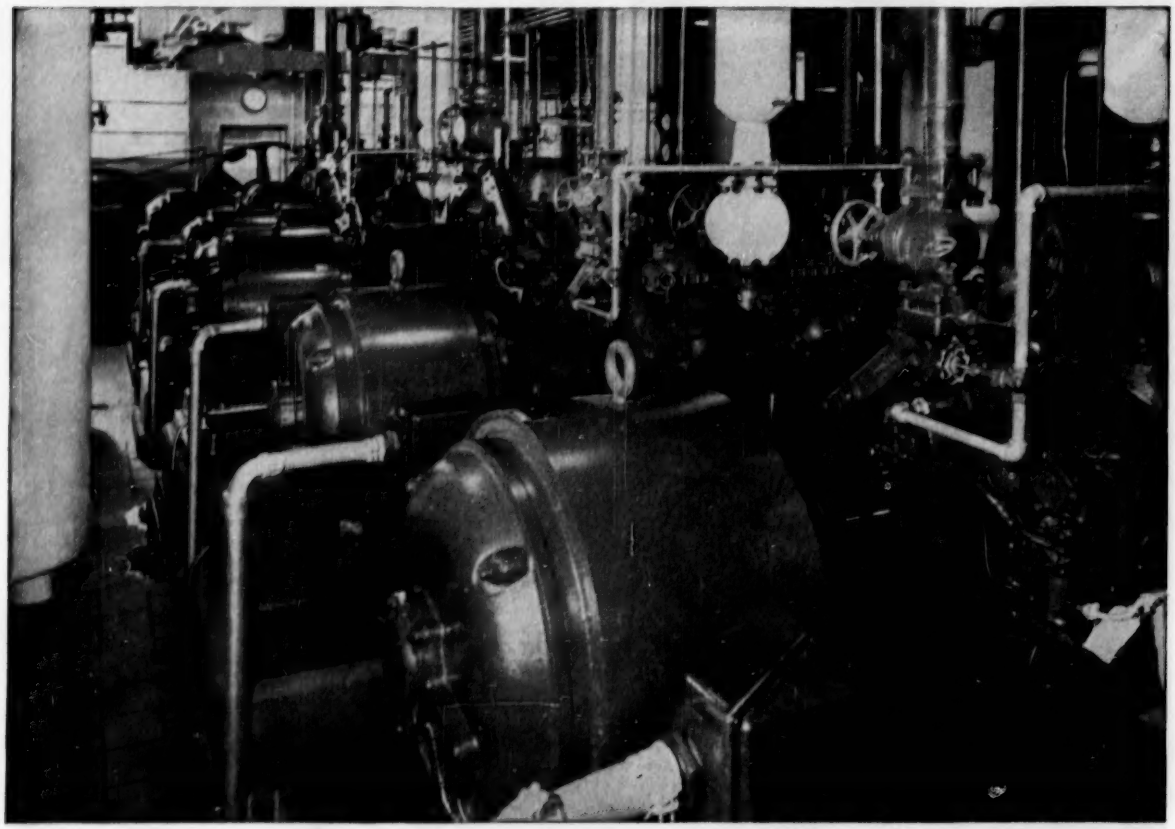
Armstrong Armatemp** Block and Blankets

Armstrong Insulcolor®, Weatherproof Coating in Eight Colors

For full information, write today to Armstrong Cork Company, 2209 Sharpe St., Lancaster, Pa.

**TRADE-MARK

WAGNER ELECTRIC MOTORS . . . THE CHOICE OF LEADERS IN INDUSTRY



Solve big motor starting problems with Wagner Increment Motor-Starter Combinations!

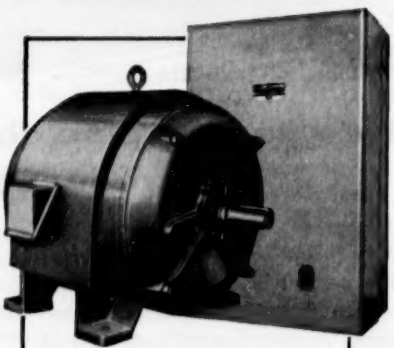
Eliminate "across the line" starts— cut voltage drop and line disturbance

This line of Wagner Increment Start Motors, ranging from 60 to 150 hp, and operating at speeds from 575 to 1160 rpm, drive compressors in a Memphis food processing plant. The motors start quickly and easily, with a minimum of line voltage disturbance, because they are designed for increment starting and are furnished with increment type starters.

Wagner Increment Motor-Starter Combinations provide *low cost control* . . . do not interrupt current between "start" and "run", as is the case with auto-transformer type starters . . . do not affect the running characteristics of the motors . . . yet fully meet the polyphase motor starting recommendations of the AEIC-EEI-NEMA.

Wagner two-step motor and starter combinations are suitable for most applications. For installations where unusually low inrush of starting current is required, Wagner can furnish 3, 4, 5, or 6 step increment motor-starter combinations.

Why don't you investigate the possibilities for savings by using Wagner Increment-start Motor Combinations on your big jobs? Your nearby Wagner engineer will help you select the increment motor and starter combination that meets your requirements. Call the nearest of our 32 branches or write for Bulletins MU-128 and MU-195.



Type RP polyphase motor — in ratings to 500 hp, with increment type starter.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

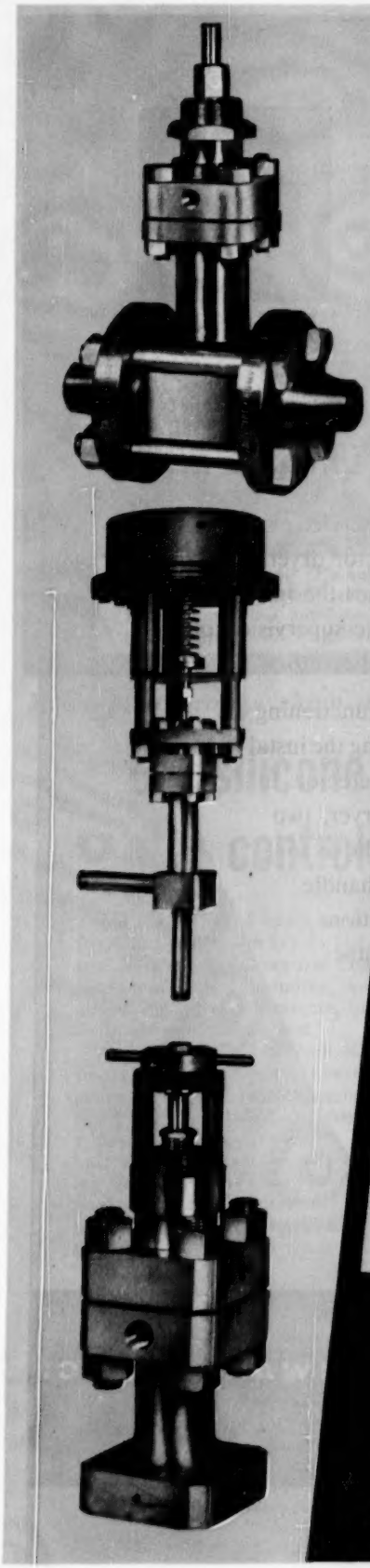
...to help America LIVE BETTER—*Electrically*

Wagner Electric Corporation
6407 Plymouth Ave., St. Louis 14, Mo., U.S.A.

LIVE BETTER ELECTRICALLY

M57-9

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC



ANOTHER NEW IDEA FROM

FULTON SYLPHON

PACKLESS VALVES

YOU CONNECT AND FORGET

Some valves are good for severe corrosives, others for high pressures and temperatures, but these Fulton Sylphon Packless Valves are *complete* valves capable of mastering the toughest possible combination of conditions in atomic energy plants and grueling chemical processes. They assure utmost safety in handling hazardous materials, require no periodic maintenance, and practically eliminate down-time.

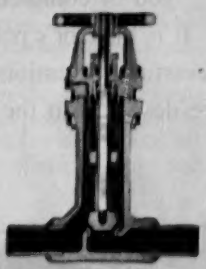
Typical of how Fulton Sylphon matches valve to process, these valves are made of stainless steel throughout, with the valve body machined as one unit from solid bar stock. And to prevent leakage or contamination, a SPECIAL SYLPHON® BELLOWS in multi-ply stainless steel forms a permanent, leak-proof seal for the stem. That is why they tame the severest corrosives inside and out. This is the reason, too, why these valves provide a high safety factor in high temperature-high pressure service.

These and other Fulton Sylphon Valves are available in many types, sizes, and metals—all with packless construction for greater safety, less maintenance and longer runs "on stream."



SEND TODAY FOR BULLETIN 813-RC

A SPECIAL SYLPHON BELLOWS which forms the permanent, leak-proof stem seal on all Fulton Sylphon Packless Valves offers four outstanding features. It is (1) cold-worked for greater resiliency and longer life, (2) seamless, without welded seams to break and leak, (3) formed in multi-plies for greater strength, and (4) made in the right metal for service requirements.





Robertshaw-Fulton

CONTROLS COMPANY

FULTON SYLPHON DIVISION · Knoxville 1, Tennessee

a series about
PROCTOR SERVICES
for your new products



Mr. Albert G. Blank
Sales Manager
Process Industries Sales

No. 7: your dryer goes into operation

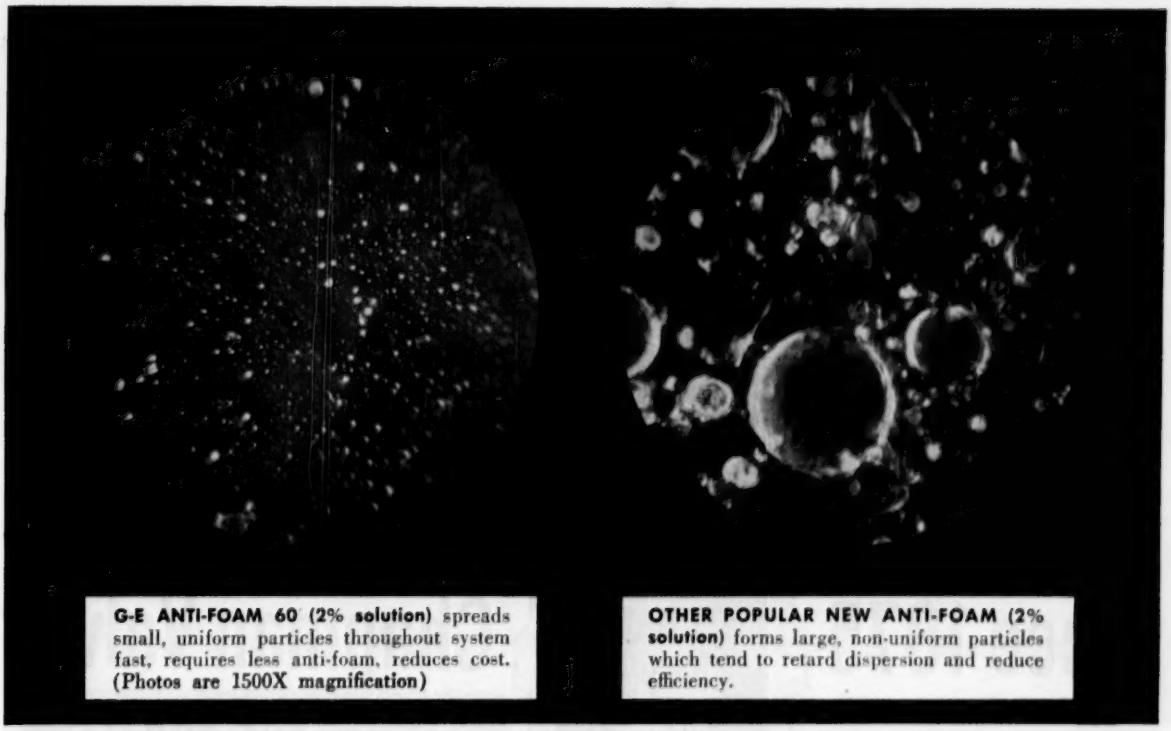
Proctor's guaranteed performance service extends to the installation and operation of your Proctor dryer. A year's mechanical warranty of parts accompanies the installation of your machine when it is done under the supervision of the loaned services of a Proctor experienced erector.

Knowledge of the dryer assembly and the functioning of its various parts is gained by your personnel during the installation period, under the instruction of Proctor's erector. In your contract covering the performance of the dryer, two weeks' service of a Proctor Field Engineer is available to you to assure you that the dryer is properly adjusted to handle your material to be dried in it, and to make your operations group familiar with conditions of the performance guarantee and how to meet them.

These services by Proctor Representatives are to assure you of complete satisfaction with your Proctor equipment. It is Proctor's policy to have a continued interest in the successful application of your Proctor machines and our services are designed to the accomplishment of this policy.

Proctor

PROCTOR & SCHWARTZ, INC.
PHILADELPHIA 20, PA.



G-E ANTI-FOAM 60 (2% solution) spreads small, uniform particles throughout system fast, requires less anti-foam, reduces cost. **(Photos are 1500X magnification)**

OTHER POPULAR NEW ANTI-FOAM (2% solution) forms large, non-uniform particles which tend to retard dispersion and reduce efficiency.

Micro-photographs show why . . .

G-E silicone Anti-foam 60 disperses faster, controls foam more economically

Rapid dispersion of small, uniform particles of anti-foam material is the key to fast, low-cost foam control. Here the performance of General Electric silicone Anti-foam 60 is outstanding. Anti-foam 60 disperses almost instantly into minute, uniform particles that destroy foam bubbles *fast*.

And with G-E Anti-foam 60 you get maximum benefit from silicone's inherent foam-destroying action, and get it *more economically* because only a few parts per million are needed in most foaming systems.

If defoaming can reduce your processing and filling time, eliminate costly boil-overs or increase your batch capacity (in aqueous systems), get a free test sample of General Electric Anti-foam 60 by mailing the coupon below. We think you will find, as many others have, that Anti-foam 60 is the most economical answer to your problems.

For non-aqueous systems—

G-E silicone fluids and compounds are also available for efficient low-cost defoaming of non-aqueous systems. Ask for free samples of SS-66 or SF-96.

SS-66 is a low-viscosity silicone anti-foam compound. Typical uses include defoaming during esterification of vegetable oils—as well as in paints, inks, antibiotic fermentation and phenolic resin cooking.

SF-96 fluids are available in standard viscosities from 40 to 100,000 centistokes for defoaming all hydrocarbons from light-end gasolines to heavy-end asphalts.

Mail this coupon for a free test sample:

Progress Is Our Most Important Product

GENERAL ELECTRIC

Silicone Products Dept.
Waterford, New York

Dept. A2E9, Silicone Products Department
General Electric Company, Waterford, New York

Please send me a sample of G-E Anti-foam

☐ **AF-60** ☐ **SS-66** ☐ **SF-96**

Application_____

Name_____ **Position**_____

Company_____

Street_____

City_____ **Zone**____ **State**_____



Since 1875 Chapman Valves for the Power Industry

Cross section of special Chapman Valve of the type used on the primary coolant loop of the first atomic submarine, the Nautilus. Operates at 2000 lb. pressure at 600°F.



Since the days when a 300 pound steam valve was considered an important development, the Valve Industry has added many higher standard pressure ratings. New and special valves have also been developed and built by Chapman, including primary coolant valves for the Nautilus; Mark I and II; A1W and S5W Valves for the first large ship reactors; valves for the Dresden reactor; and many others.

Chapman Valve, since its organization in 1875, has kept in step with developments in the Power Industry; meeting promptly and efficiently the demands for valves to withstand increased pressure and temperature specifications. The Chapman line today covers a complete standard range to 2500 lb. and special designs for super-critical pressures.

Keeping pace with the Power Industry . . . keeping pace with all industries . . . has kept Chapman alive and aggressive. Every phase of manufacturing is under close supervision. Chapman foundries manufacture its casting requirements under technical supervision with results checked by a million volt x-ray machine to insure a maximum quality product. All Chapman equipment and operations are designed to meet exacting demands with valves that give top performance with the lowest maintenance cost.

The CHAPMAN Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS



Extending the Frontiers of Chemical Processing

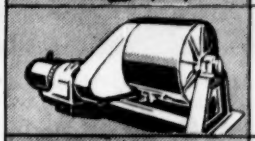
"INTERNATIONAL" BUILDS



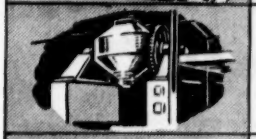
RIBBON MIXERS
For resins and plastics, metallurgicals, Dye and Foodstuffs, grains, fertilizers, etc.



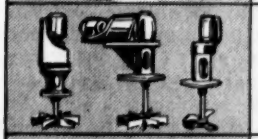
PORTABLE MIXERS
Pilot plant and Laboratory Equipment—Chemical, Petro-Chemical and Ceramic.



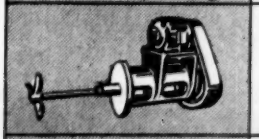
BALL MILLS
Both batch and continuous conical types, with complete classifying systems.



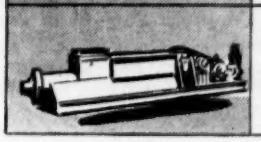
DRY BLENDERS
For intimate, rapid and efficient blending of Chemicals, drugs and metallurgicals.



TOP ENTERING AGITATORS
Slow speed or Hi-Speed, direct or gearmotor drive, Turbine or Propeller types.



SIDE ENTERING AGITATORS
With standard packing or New Mechanical Seal—For synthetics, gasoline and lube-oil products.



EXTRUSION MACHINERY
With "Vac Aire" de-airing—complete agglomeration equipment—Muller Mixers, Crushers, Filter Presses, etc.

The axiomatic phrase that *"anything which can be postulated is possible,"* is being successfully demonstrated through Chemistry every day—that which was only a laboratory triumph yesterday becomes a production possibility today.

In adapting these new incentives commercially, and converting the raw materials into consumer products International Engineering lends the hand of cooperation with technological and mechanical know-how .... International has experience you can profitably use, and the difference in processes alone could be worth thousands of dollars to your company.

INTERNATIONAL BUILDS BETTER EQUIPMENT —That's why you'll find the International nameplate in most of the Leading Chemical and Allied Products plants all over the world—International Equipment is designed to allow for low cost modification as may be necessary for future requirements in performance and capacities,—*in various instances saving the cost of complete replacement.*

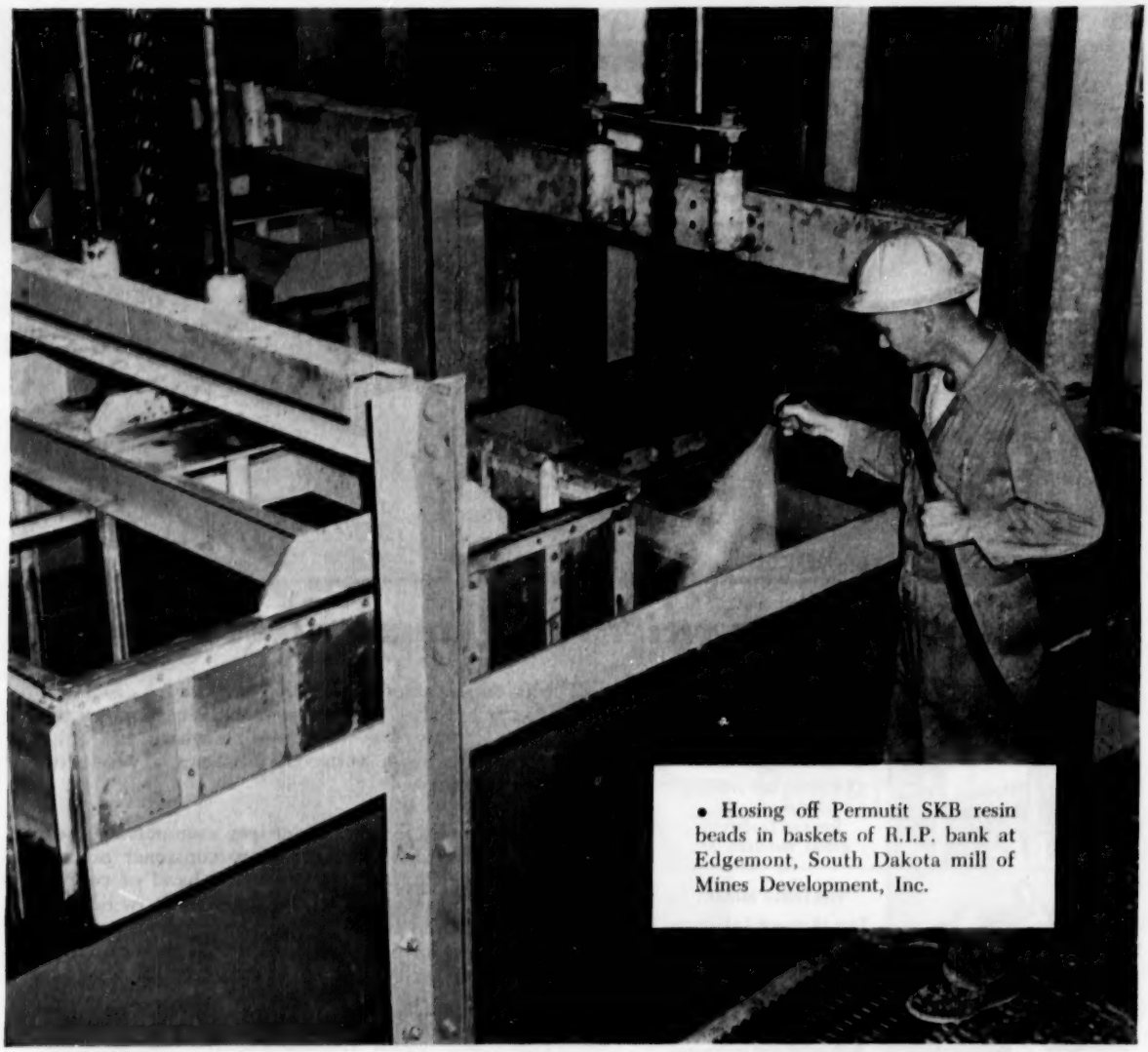
If you have a problem in Production, Mixing, Treating, Blending or Grinding simply drop us a line for Complete Technical Bulletins on the subject in which you are interested. There is no cost or obligation.

International Engineering, Inc.

DAYTON 1, OHIO

NEW YORK, 15 Park Row — WOrth 2-2580

MFRS OF CHEMICAL PROCESSING EQUIPMENT, VENTILATING FANS, STACK-FANS, AXIAL BLOWERS, BRICK, TILE, POTTERY, AND CERAMIC MACHINERY



• Hosing off Permutit SKB resin beads in baskets of R.I.P. bank at Edgemont, South Dakota mill of Mines Development, Inc.

Edgemont R.I.P. mill loads 4 lb. of U_3O_8 per cu. ft. of Permutit SKB resin!

• Here's how low-slime pulp and Permutit SKB ion-exchange resins are producing at Mines Development's efficient mill: a loading of 4.0 lb. of uranium oxide per cu. ft. of resin, a concentration of 10 to 12 grams of uranium oxide per liter of eluate, and an R.I.P. uranium recovery of 99.7 per cent with a minimum of iron, vanadium and aluminum impurities.

It's proof of Permutit SKB resin's high uranium capacity and recovery ratio under actual production conditions. It explains why a number of R.I.P. mills have switched to this unique resin.

Permutit SKB was developed especially for R.I.P. uranium extraction. It disperses well, preventing "blinding" of the baskets and improving resin-pulp contact. Its unique chemical structure gives it fast loading for high recovery, high capacity and fast elution. This results in extremely high concentrations of recovered uranium, particularly in nitrate elution systems. It also means low precipitation costs and a high purity uranium.

Permutit SK (finer mesh than SKB) offers the same chemical advantages when used for uranium extraction in ion-exchange columns.

We'll supply full details and samples to help you evaluate Permutit SK, SKB or other ion exchange resins. Write: The Permutit Company, Dept. CE-9, 330 West 42nd St., New York 36, N. Y. or The Permutit Company of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®

rhymes with "compute it"

ION EXCHANGE for Water Conditioning
Chemical Processing • Industrial Waste Treatment

THE RIGHT STEAM TRAP FOR LIGHT CONDENSATE LOADS



YARWAY 20-A IMPULSE STEAM TRAP

There's a Yarway Impulse Trap for every trapping need



SERIES 60 AND 120

For all *normal* trap requirements, pressures to 400 and 600 psi.



½" No. 20-A

For *light loads* on tracer lines, steam mains, small presses, etc.



SERIES 40

For *heavy loads* requiring extra high capacity steam traps.

INTEGRAL-STRAINER HIGH PRESSURE TRAP



For *high pressures, high temperatures.* (Flanged or welding connections.)

● Successful companion to the standard Series 60 YARWAY Impulse Steam Trap, the ½" No. 20-A is right and recommended for *light load* applications in:

REFINERIES, CHEMICAL AND PROCESSING PLANTS on steam tracer lines, meter boxes, steam mains, separators, small dryers, pipe coils, small unit heaters, etc.

POWER PLANTS on headers, fuel oil preheaters, compressed air lines, small steam jacketed fire pumps, etc.

HOSPITALS, SCHOOLS, HOTELS AND INSTITUTIONS on autoclaves, sterilizers, steam tables, washers, small pressure cookers, steam mains, etc.

LAUNDRIES on small presses, puff irons, sock forms, drying cabinets, starch cookers, steam mains, etc.

The 20-A has all the YARWAY Impulse Trap features such as small size, stainless steel body and working parts, low cost, non-freezing—and immediate availability through 270 local Industrial Distributors.

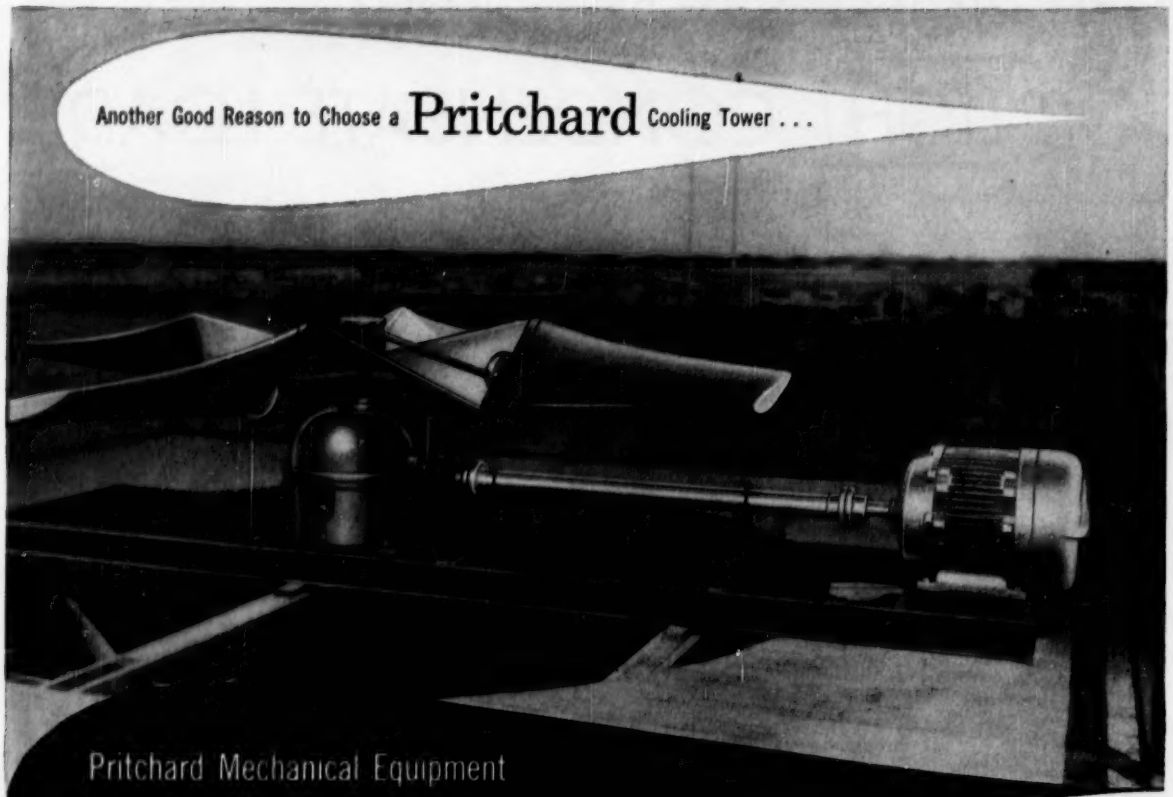
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YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE® STEAM TRAP

OVER 1,000,000 YARWAY IMPULSE STEAM TRAPS USED

Another Good Reason to Choose a **Pritchard** Cooling Tower . . .



Pritchard Mechanical Equipment
Is Designed Expressly for Cooling Tower Use

Let's take a look at the mechanical equipment used in all Pritchard industrial towers . . .

FANS—Pritchard POWairSAVER Fans were developed specifically for cooling tower service. Blades, of airfoil design, are pitched to pump as much air at the hub as at the tip of the blade. The hub construction eliminates air back flow near the hub. Thus, you get high aerodynamic efficiency with low horsepower on this adjustable pitch fan. Monel or stainless steel blades are available to meet specific anti-corrosion requirements.

GEARS—Right angle, spiral bevel, reduction gears drive the fans. The gear, designed specifically for cooling tower service, is manufactured to meet the high standards of the American Gear Manufacturer's Association. The reducers, equipped with oversize shafts and bearings, and specially sealed rugged cases, deliver long service with little maintenance.

DRIVE SHAFTS—The full floating drive shaft, consisting of forged steel couplings, stainless steel flexible discs and corrosion resistant tube, does not require lubrication.

SUPPORTS—A unitized, welded structural steel support, carrying the fan drive, is securely bolted to the tower framework. Motor and gear are dowelled, after alignment, to assure permanent alignment of motor, gear and shaft.

With all these components working together, you are assured the very best in operating efficiency and longer life from your cooling tower.

WRITE TODAY FOR MORE INFORMATION
Pritchard is now preparing a brochure that tells and illustrates in detail how Pritchard builds a better cooling tower for you. This brochure will be available in the near future. For this and other data drop us a note on your company letterhead, today. There's no cost, no obligation, of course.

INDUSTRY'S PARTNER FOR PROGRESS

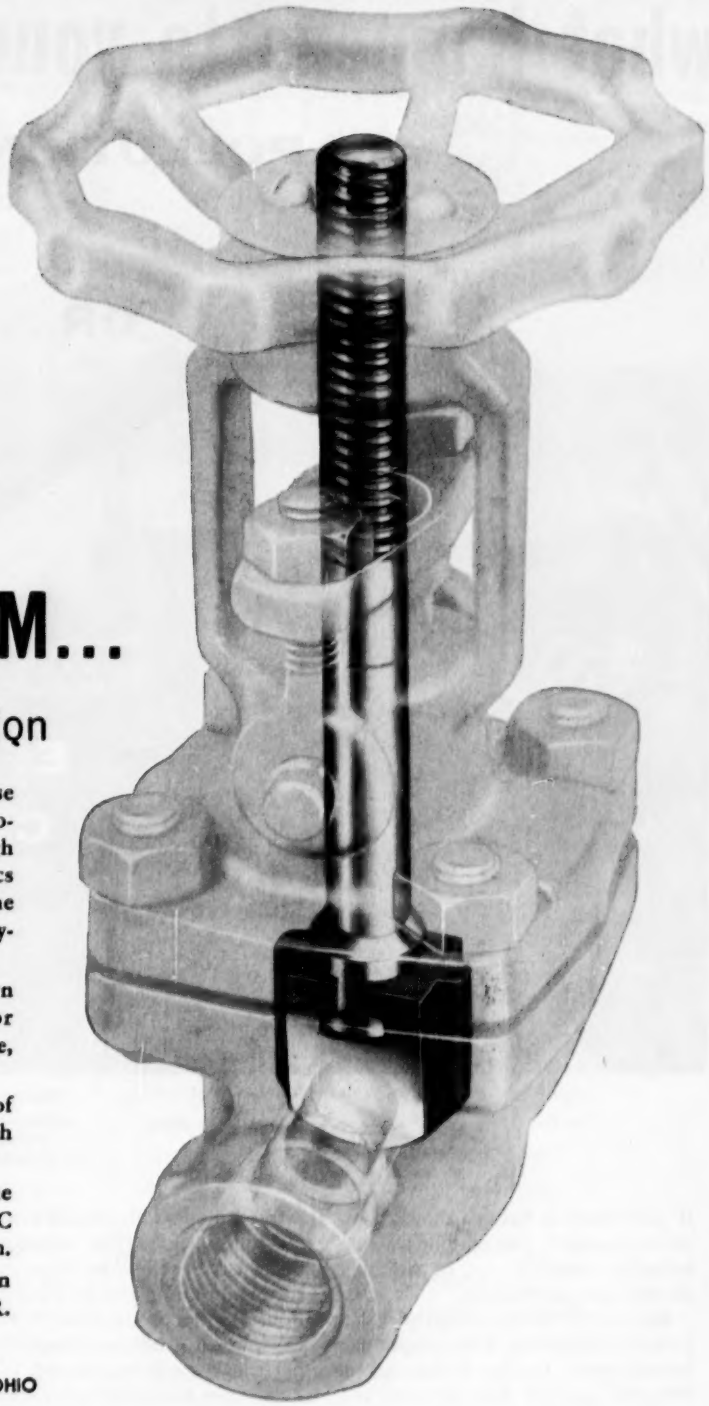
COOLING TOWERS
GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES
IN PRINCIPAL CITIES
FROM COAST
TO COAST

J.F. **Pritchard** & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO
Dept. 579, 4625 Roanoke Parkway, Kansas City 12, Mo.

1000 BRINELL DURACASE TRIM...

Stops galling and erosion



Since the introduction of OIC's Duracase Trim, many forged steel valve specs are obsolete. This 13% chrome stainless steel trim with 1000 Brinell, case-hardened wedges and discs assures positive protection against even the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling.

OIC offers you a choice of two modern body-bonnet connections—union ring or bolted bonnet—on its entire forged steel gate, globe, angle, and check valve line.

In addition, gate valves offer a choice of standard-flow or high-flow body ports, both with 1000 Brinell wedges.

Step up your valve requirements to the modern high-quality standards reflected in OIC valves. Include OIC on your next specification.

For OIC forged steel valve specification literature, write for Forms No. 195 and 195-R.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO



OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

what happens to your dust?

AIR POLLUTION...

OR . . .



Kentile, Inc., found a Dracco Multi-Bag Filter to be the ideal solution to air pollution problems created by an inadequate cyclone-type collector. Filter collects ½-ton of dust daily from processing of Kentile Cork Tile.

If your dust is being exhausted to the atmosphere, you may be wasting valuable materials . . . or violating air pollution ordinances.

But if it's being collected by a Dracco Multi-Bag Filter, you can breathe easy. Dracco Filters collect 99½-100% of all dust particles and exhaust only clean air with no visible dust to the atmosphere.

Kentile, Inc., Brooklyn (N. Y.) installed a Dracco Multi-Bag Filter to avoid trouble with city officials. An old-style cyclone-type collector was being used to collect dust from cutting, slitting, grinding and finishing operations in the production of Kentile Cork Tile for walls and floors. Larger particles were being trapped, but fine dust—*over half-a-ton a day*—was escaping. By installing a Dracco Filter engineered to exact job requirements, Kentile now prevents air pollution. Dusty air is carried from the cyclone through a large pipeline into the heart of the filter, collected in the hoppers and bags, then automatically discharged for convenient disposal.

If your plant is polluting the atmosphere with dust, or if you have any other dust problems, check with Dracco for a cost-saving switch from problems to profits.

DRACCO CORPORATION
4040 East 116th Street · Cleveland 5, Ohio

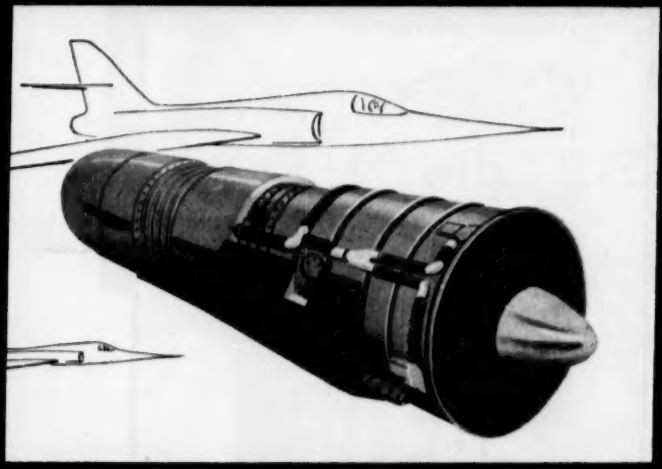
Bulletin 800 is Dracco's 40-page catalog on dust control and recovery. Contains detailed facts and figures on all dust control equipment. For your copy, write Dracco today.

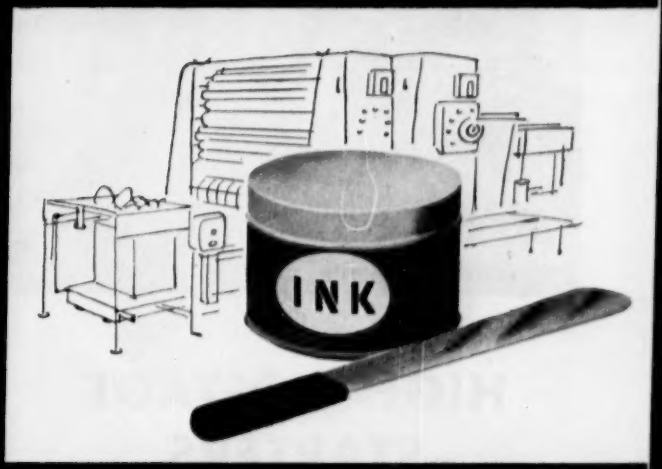
DRACCO *airstream* conveyors
dust control equipment

frequent EQUIPMENT ADJUSTMENT is a problem

that Mallinckrodt® uniformity has often solved

MALLINCKRODT PROCESS CHEMICALS MEET DIFFICULT SPECIFICATIONS FOR MANY INDUSTRIES





Misch Metal in alloys

Misch metal, an alloy of rare earth metals, provides magnesium casting alloys with qualities particularly applicable to jet engine parts. *Misch metal* decreases the porosity of the alloy, giving it pressure tightness, and increases its high-temperature creep resistance – the ability to withstand long periods of stress at high temperatures without distortion. The addition of *misch metal* to certain stainless steels improves their fabricating properties. Freedom from oxide coating is unique with Mallinckrodt *misch metal.* Technical information is available on request.

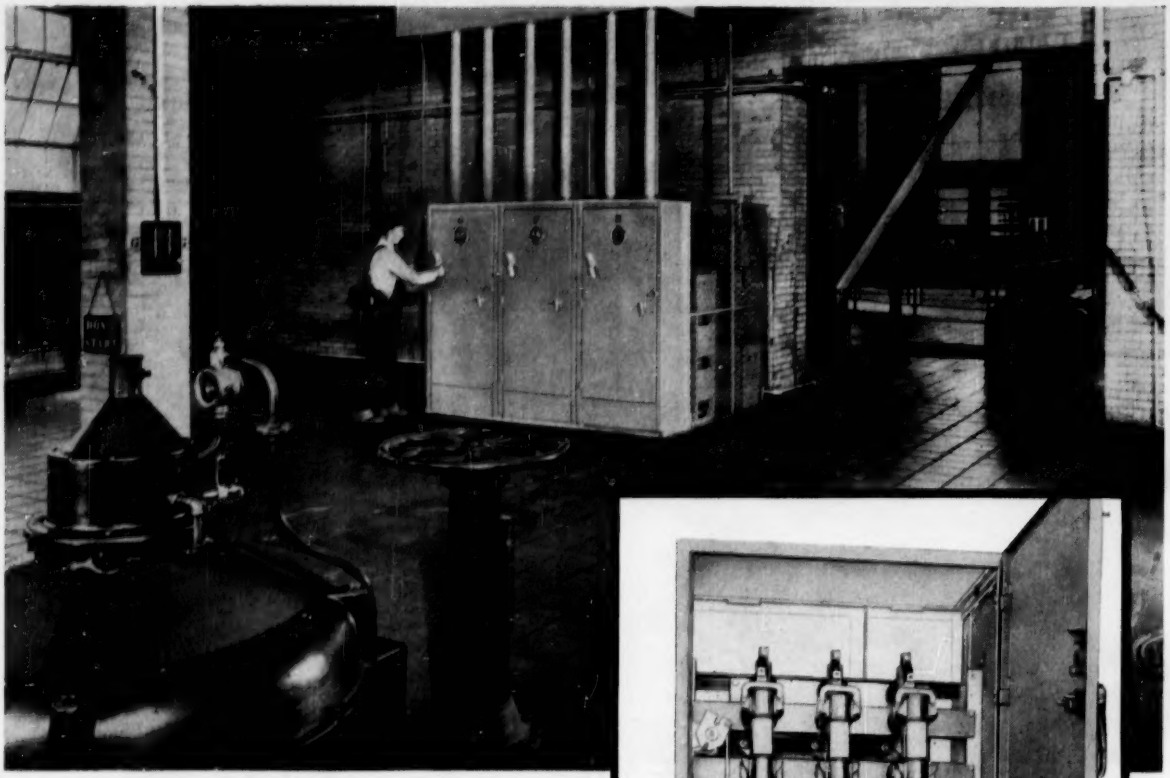
Gallotannins for many uses

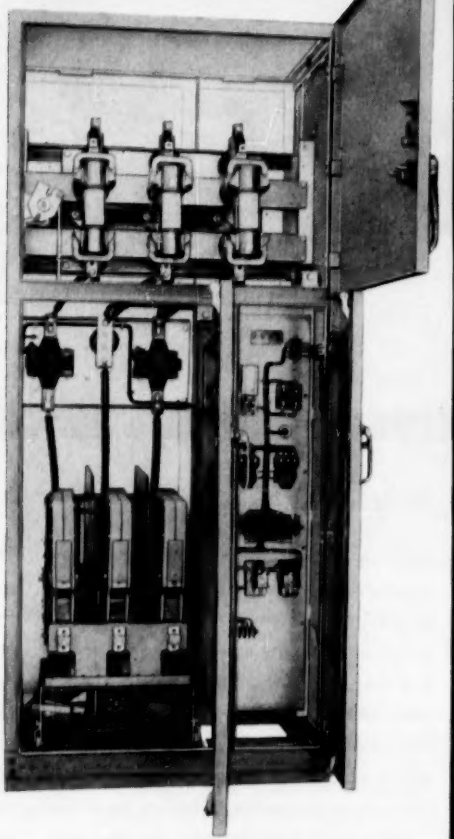
Tannic Acid is used in printing inks where it improves bleed-resistance, aids in pigment suspension, adds gloss and provides permanence. It serves as a coagulant and stabilizer in wine and other beverages. *Gallic* and *pyrogallic acids* are used in dressing and dyeing furs. It is also used to coagulate aqueous suspensions of asbestos. The rubber industry has found *pyrogallol* helpful in vulcanizing synthetic rubber, inhibiting hardening and softening, and as a stopping agent in the copolymerization of GR-S rubber.

Your particular application of these *and other Mallinckrodt industrial chemicals* may be different. Drop us a note on your requirements – *you might be better served by Mallinckrodt.*

Mallinckrodt® MALLINCKRODT CHEMICAL WORKS

SECOND & MALLINCKRODT STREETS, ST. LOUIS 7, MO. • 72 GOLD STREET, NEW YORK 8, N. Y.
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HIGH VOLTAGE STARTERS by ALLEN-BRADLEY

The NEW Allen-Bradley air break, high voltage contactor is the basic unit of a complete line of high tension starters for large synchronous and squirrel cage motors. They are available for full voltage or reduced voltage starting, and for reversing and nonreversing service. These big starters are also offered for part winding and multispeed motors.

Maximum ratings range from 1750 hp, 2000-2500 v to 3000 hp, 2501-4600 v. All starters in this class have an interrupting capacity of 150,000 kva at 2300 v, and 250,000 kva at 4600 v. Current limiting fuses are standard on all Allen-Bradley high tension starters.

Send today for the new Bulletin 6080, describing and listing the full line of Allen-Bradley High Voltage Starters.

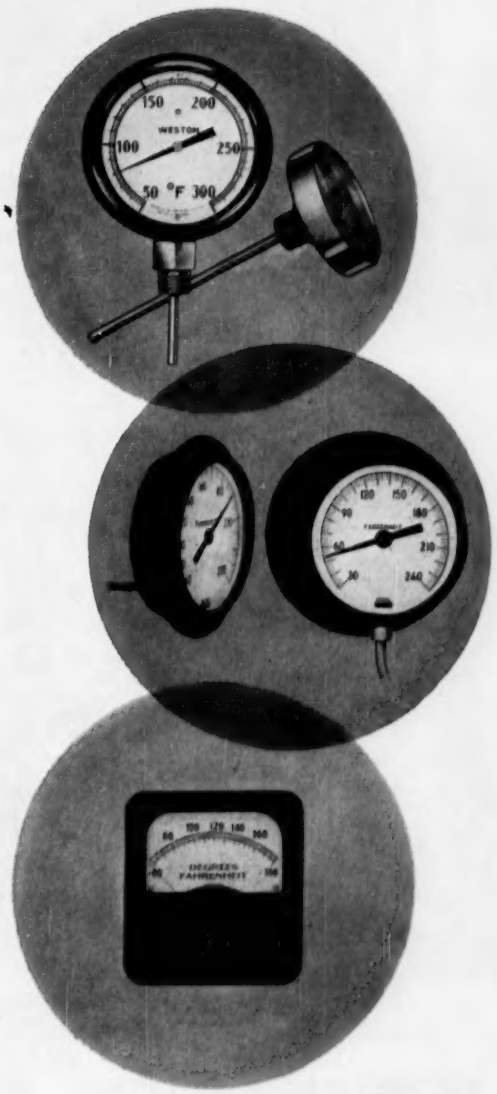
Bulletin 1159 nonreversing automatic, across-the-line starter for high voltage squirrel cage motors on pumps, air and refrigeration compressors, etc. Max. ratings: 1500 hp, 2400 v; 2500 hp, 4000-4600 v.

ALLEN-BRADLEY
QUALITY MOTOR CONTROL

Allen-Bradley Co.
1337 S. First St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

3 WAYS TO MEASURE TEMPERATURE



bi-metal

THERMOMETERS

for industrial and "built-in" needs

Overwhelmingly preferred because of their all-metal ruggedness, stability and long life. In heavy duty types, straight and angle forms, 6" and 5" dia heads – industrial types, angle form, 3" and 2" heads; stainless steel stems, lengths from 2½" to 24". Ranges low as –100 F to high as 1000 F; accuracy 1% of range.

filled system

THERMOMETERS

for remote readings–alarms

Available with mercury, liquid, gas filled, or vapor pressure actuations in 5", 6" and 8" dial sizes – for wall or flush mounting. Models to indicate as low as –325 F or as high as 1000 F. Available with adjustable electrical contact and index pointer for signal or alarm needs.

electrical resistance

THERMOMETERS

for remote and multiple readings

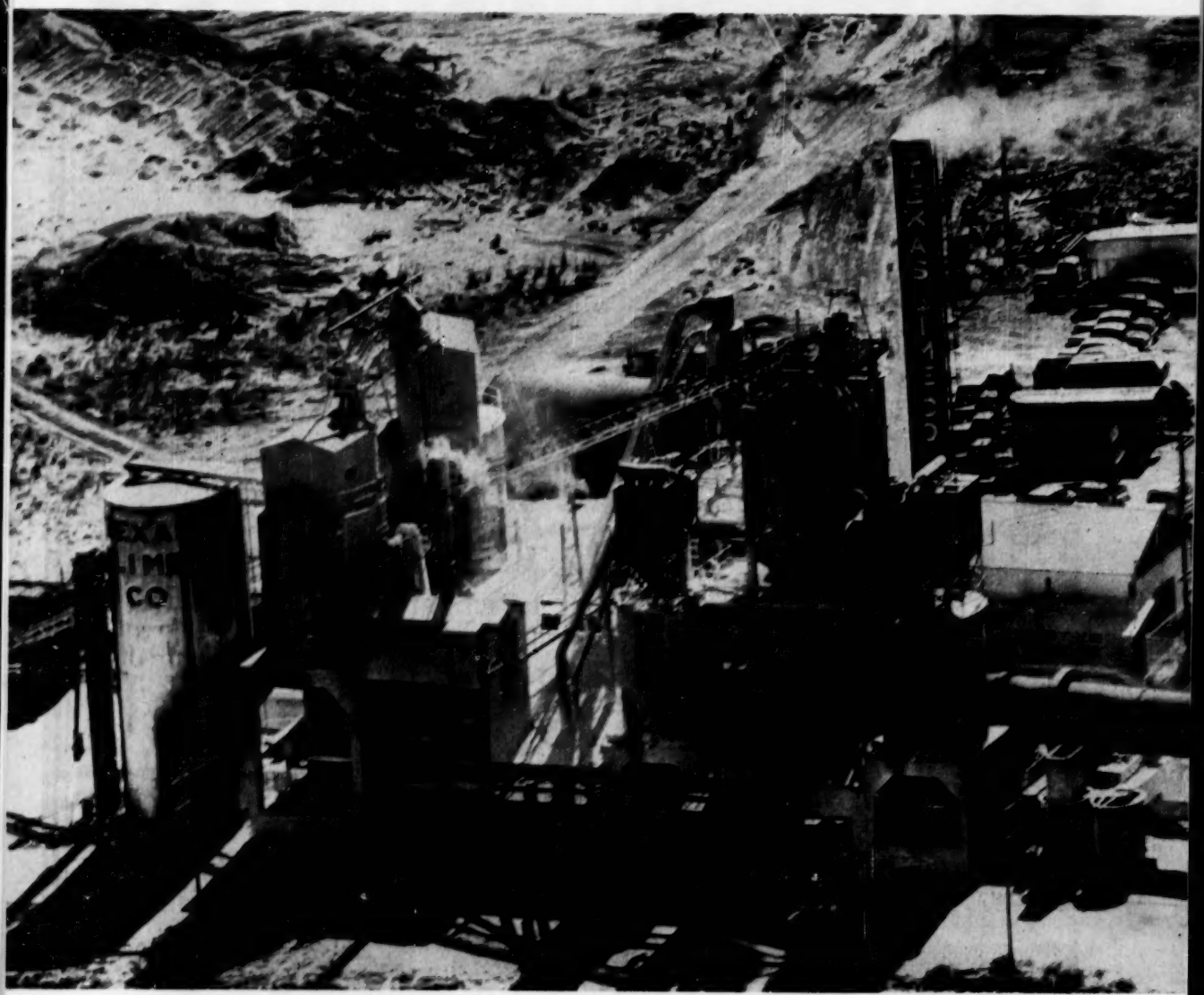
Resistor bulb permits remote temperature readings – and by use of several bulbs, several different remote temperature measurements can be made using a selector switch. Accuracy 1% of full scale. Ranges low as –100 to high as 500 F.

For literature write . . . Weston Electrical Instrument Corp., Newark 12, N. J.

WESTON THERMOMETERS

150 TON PER DAY LIME

ALL MAJOR PROCESSING EQUIPMENT DESIGNED AND BUILT BY KENNEDY



KENNEDY-VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION
TWO PARK AVENUE, NEW YORK 16, N.Y. • FACTORY, DANVILLE, PA.

PLANT...

...at Texas Lime Company

Cleburne, Texas



TEXAS LIME COMPANY—150 Ton Per Day Lime Plant. 9' x 130' KENNEDY Rotary Kiln with Preheater and Deheater.

SEND FOR BULLETINS DESCRIBING KVS MACHINERY AND EQUIPMENT

CHECK √ *these Features for*

LOW FUEL CONSUMPTION

LOW MAINTENANCE

HIGH QUALITY LIME

MINIMUM LABOR REQUIREMENTS

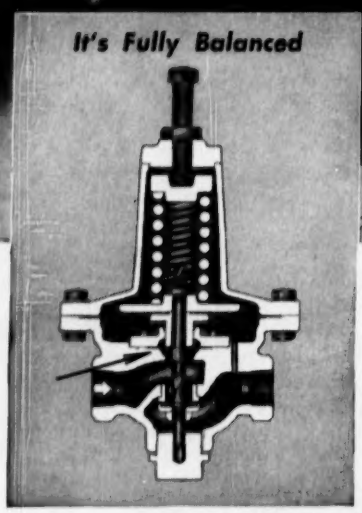
- √ *Kennedy Stone Preheater*
- √ *Kennedy Short—2 tire rotary kiln*
- √ *Kennedy Lime Deheater*
- √ *Kennedy Natural Gas Burner especially designed for rotary kiln operation*
- √ *Kennedy Centralized Kiln Control Cubicle*

Similar installations throughout the world are noteworthy for their DEPENDABILITY and PROFITABLE OPERATION.

Consult us for a complete lime plant or any part thereof.

Here is the new LESLIE "HI-FLO" Water Reducing Valve with 50% more capacity





Unique construction of "Hi-Flo" Reducing Valve. Note the small lower diaphragm that provides fully balanced, floating action.

HERE IS THE ALL NEW Leslie Reducing Valve with *capacity-regulation* features that have never been offered before. Here is a regulator with 50 - 100% greater capacity by actual test.*

Here's the unbeatable combination of design features:

"HI-FLO" — Large bowl construction; long stroke diaphragm gives full flow of water and other non-corrosive liquids.

FULLY BALANCED — The main valve, fully balanced by lower diaphragm, virtually floats to provide smooth, friction-free, throttling action.

DROP-TIGHT SHUTOFF — Resilient seating disc provides tight closure under all conditions.

TROUBLE-FREE DESIGN — Chatter and hammer eliminated; no piston cups or seals to clog or change. Corrosion resistant trim with renewable interchangeable fit.

Ask your Leslie Engineer to show you how the exclusive Leslie "Hi-Flo" valve can be used to your advantage in water reducing stations, fuel oil pressure control, process lines, etc. He's in your classified directory under "Valves" or "Regulators".

Write today for Bulletin 553 for graphic performance comparison and complete capacity data.

TRADE LESLIE MARK

REGULATORS AND CONTROLLERS

LESLIE CO., 279 GRANT AVENUE, LYNDHURST, NEW JERSEY

139

CONTROLLED QUALITY MEANS QUALITY CONTROLS

PRINTED IN U.S.A.

How can graphite be used in our new cell design?

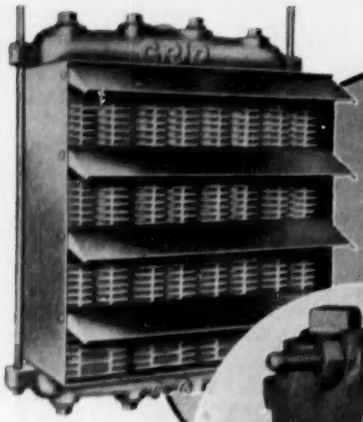


Let's get in touch with Great Lakes Carbon—they've always been helpful, and their product performance is outstanding!

ELECTRODE GLC® DIVISION

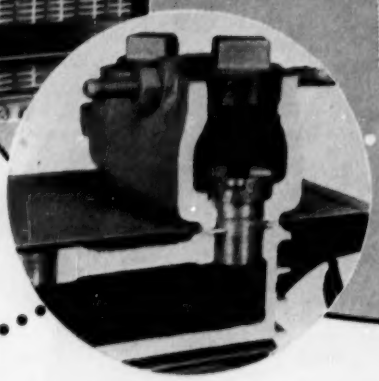
GREAT LAKES CARBON CORPORATION

18 EAST 48TH STREET, NEW YORK 17, N.Y. · OFFICES IN PRINCIPAL CITIES



GRID

CAST IRON STEAM HEAT TRANSFER SURFACE



*ends Unit Heater Maintenance Problems!

Your answer to unit heater problems the Chemical industry has discovered through common failures of copper, aluminum, and steel tube heat transfer surface. GRID condenser eliminates internal electrolytic corrosion—because all metals in contact with steam are similar. GRID also eliminates external corrosion— because the cast iron construction resists acid or other fumes in the air and eliminates the use of reducing valves where high steam pressure is used. GRID cast iron construction is tested to withstand steam pressures up to 250 P.S.I. . . . 450° temperature. GRID eliminates the high maintenance costs generally experienced with other types of condenser construction . . . eliminates replacement costs because GRID is built to last for years . . . uninterrupted service records of more than twenty years are common among GRID users in the Chemical industry. Study the illustrations and descriptions to the right and you will see why GRID gives you maximum heating performance always.

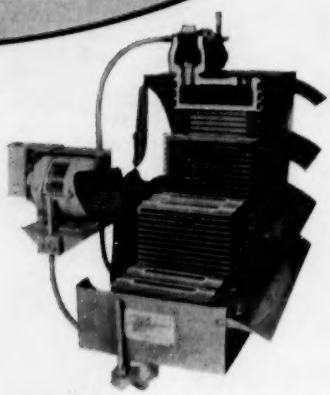


Send for the complete story on GRID Unit Heaters, GRID Blast Heaters, and GRID Radiation for chemical plant use . . . it is contained in GRID Products Catalog No. 956. Write today for your copy.

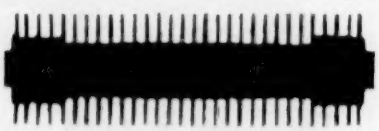
D. J. MURRAY MANUFACTURING CO.

MANUFACTURERS SINCE 1883

WAUSAU, WISCONSIN



Cut-away view of Model 2000 GRID Unit Heater . . . note double steam chambers in each fin section and wide fin spacing . . . fins are cast integral with steam chamber.



All cast iron one-piece, single chamber fin section used in Model 1000 and Model 1200 GRID Unit Heaters . . . note wide fin spacing and ample radiation surface.



All cast iron, one piece, double chamber fin sections are used in Model 1500 through models 3000 GRID Unit Heaters, all GRID Blast Heaters and all GRID Radiators. Wide fin spacing prevents clogging by lint or dust . . . finned surface is easily cleaned . . . straight through air passage reduces resistance. Steam inlet at top serves both steam chambers permitting quick, even steam distribution. Outlet section at bottom serves both steam chambers permitting quick condensate discharge. Inlet and outlet openings are 1" P. T.

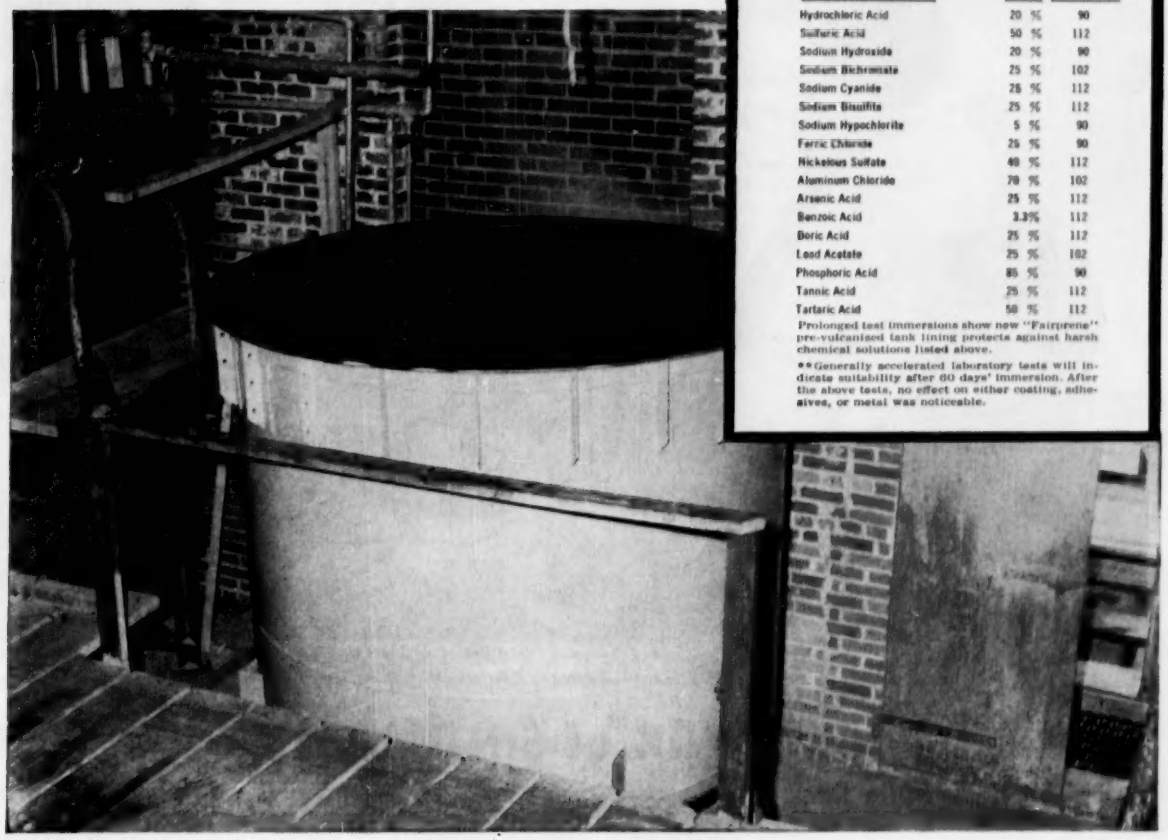
NEW—protective lining sheet that needs no vulcanizing

IMMERSION TEST TABLE
Steel Panels Covered with "Fairprene" in Corrosive Solutions at 212°F.

Immersion Medium	Conc.	No. Days**
Hydrochloric Acid	20 %	90
Sulfuric Acid	50 %	112
Sodium Hydroxide	20 %	90
Sodium Bichromate	25 %	102
Sodium Cyanide	25 %	112
Sodium Bisulfite	25 %	112
Sodium Hypochlorite	5 %	90
Ferric Chloride	25 %	90
Nickelous Sulfate	40 %	112
Aluminum Chloride	70 %	102
Arsenic Acid	25 %	112
Benzoic Acid	3.3%	112
Boric Acid	25 %	112
Lead Acetate	25 %	102
Phosphoric Acid	85 %	90
Tannic Acid	25 %	112
Tartaric Acid	50 %	112

Prolonged test immersions show new "Fairprene" pre-vulcanized tank lining protects against harsh chemical solutions listed above.

**Generally accelerated laboratory tests will indicate suitability after 60 days' immersion. After the above tests, no effect on either coating, adhesives, or metal was noticeable.



Economical new pre-cured Fairprene® lining material provides superior protection against hot corrosive solutions

Because Du Pont's new "Fairprene"* protective lining material is pre-vulcanized, Livingstone Coating Corp., custom applicators, were able to line the above tank on location. "Fairprene" protects against chemical action that would corrode the tank and contaminate the solution it contains at North Carolina Finishing Co., Salisbury, N. C.

"Fairprene" sheet stock is made specifically for protective lining which offers outstanding resistance to harsh chemicals, ozone, oxidation, aging and abrasion. "Fairprene" shows superior heat resistance—can be used at temperatures as high as 200°F. Lining costs are reduced because "Fairprene" is pre-cured. It needs no special storage or shipping conditions, does not deteriorate with age and can be applied on location to minimize equipment downtime. Du Pont "Fairprene" lining is offered in a complete system of materials including sheet (rolls 50" wide and ⅛" thick), tape, cements, activators and putty.

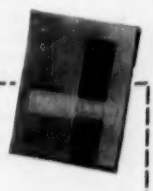
Find out more about the low-cost protection you can give your equipment with "Fairprene" protective lining material. Mail the coupon.

DU PONT INDUSTRIAL COATED FABRICS SHEET STOCKS • CEMENTS

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

*"Fairprene" is Du Pont's registered trademark for its coated fabrics, sheet stocks and cements.



E. I. du Pont de Nemours & Co. (Inc.)
Fabrics Division, CE-9, Wilmington 98, Del.
Please send me your booklet on "Fairprene" pre-vulcanized protective lining.

*Name*_____ *Position*_____

*Company*_____

*Address*_____

*City*_____ *State*_____



F. J. Tompkins, Chief Design Engineer (right), Bernard Anik, Mechanical Engineer (left rear), Singmaster & Breyer, N. Y. C. Foreground, Michael De Piano, Cooper Alloy Corp.

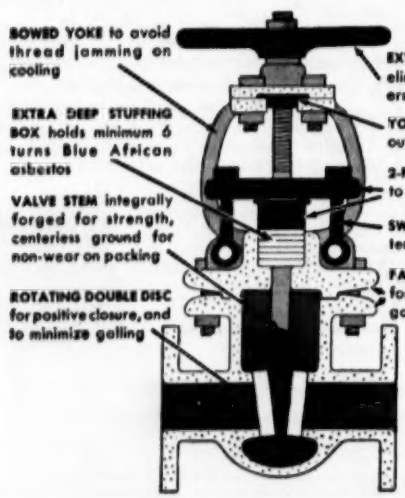
TOMPKINS and ANIK of SINGMASTER & BREYER

tell why they build Cooper Alloy stainless valves into their basic plant designs

Q. Gentlemen, precisely why do you buy Cooper Alloy valves?

FJT—With me, dependability is the main reason. My major concern is overall plant design, and frankly I don't have time to worry about every equipment detail. As specialists in designing and building "first-of-its-kind" processing plants, we need valves we can count on, and can "build in" as part of our original design. Cooper Alloy valves, we've found, fill that bill.

BA—From my point of view as a mechanical engineer, it's the Cooper Alloy valve *design* that appeals to *me*. It has extra features, like the extra-large handwheel, unique square compression of packing, bowed yoke, integrally forged stem, and others, all of which make for less maintenance and longer, more economical valve life.



A VALVE DESIGNED FOR STAINLESS!

The Cooper Alloy valve is not an adaptation of earlier brass and iron patterns. Cooper Alloy, with over 35 years of experience in handling stainless steel, created a valve *designed to be cast in stainless!* **Check the Special Design Features shown at left.**

As the little CA man below is saying: *"You can tell a Cooper Alloy Valve as far as you can see it!"* Write today for *your* copy of our folder "Design Factors In Stainless Steel Valves." The Cooper Alloy distributor near you will be glad to show you the complete line of Cooper Alloy valves *and fittings*, and their advantages. He can serve you promptly from local stocks.

COOPER ALLOY

Corporation • Hillside, New Jersey

VALVE & FITTING DIVISION

THIRTY-FIVE YEARS OF STAINLESS STEEL PIONEERING

One of a series.

Some Things to Think About Steam Traps

. . . in order to get high operating efficiency and a minimum of maintenance

The gentleman who invented the wheel had a basic idea and so far no one has come up with anything better for the purpose.

If you'll pardon us for a little overemphasis on the significance of steam traps, we'd like to liken one of them to the wheel.

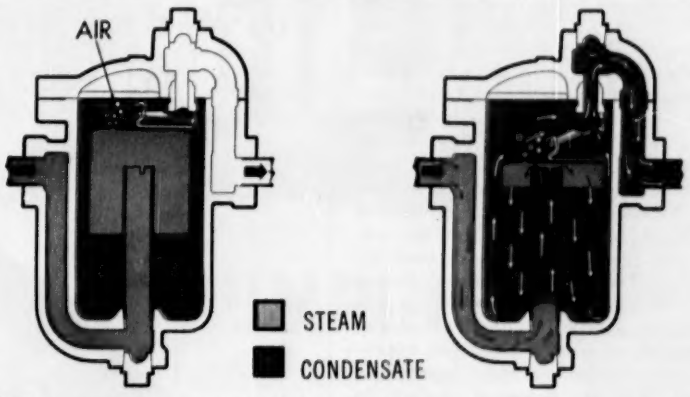
In 1911, when the first Armstrong inverted bucket steam trap model was announced to the world, or at least that part of the world that modest advertising and sales budgets would cover, it was not received with equal enthusiasm by all (especially old-style trap makers). But, like the wheel, it managed to find its way into general use. And, nothing better has ever turned up for the purpose of draining condensate. As a matter of fact, the Armstrong trap has been very widely copied. Today, there are more inverted bucket traps draining process equipment than any other kind. Of these, there are more Armstrongs.

If this sounds like the boasting of a proud parent, give consideration to some fundamental requirements not met by all traps:

1. ***A steam trap should not leak steam.*** Some traps do, you know, because of the nature of their operating principle. No steam ever gets to the Armstrong trap orifice. The valve is always water sealed.

2. ***A steam trap should vent "air" as fast as it accumulates***—otherwise temperatures are reduced and corrosion is a problem. The Armstrong trap handles air very nicely. The vent in the bucket permits air to accumulate in the top of the trap, from where it is discharged when the trap opens. For extreme conditions like draining paper machine dryers, some jacketed kettles and certain other units, the vent is sized larger for the job. And, for handling big volumes of air during warm-up, a bucket with an auxiliary thermic vent really speeds up heating.

3. ***A steam trap should discharge condensate at steam temperature*** if you want to get maximum efficiency from the unit drained. And most people certainly do. If you have to wait for the condensate to cool, it's almost impossible to maintain maximum temperatures and prevent air build-up. You guessed it—the Armstrong trap opens for water, without dependence on temperature.



Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

4. ***A steam trap should be suitable for any return system.*** The Armstrong trap works just the same whether discharging to atmosphere, back pressure or vacuum. It has been conclusively proved that flash steam resulting from use of a bucket trap does not cause a problem in vacuum return systems. The flash condenses rapidly. It's the leaky traps that cause the headaches.

5. ***A steam trap should not be a "prima donna".*** Some kinds of traps take an awful lot of care and coddling. The Armstrong trap is a rough and ready type with a hardened chrome steel constitution (valve and seat, to be exact). It cleans itself of ordinary dirt and scale without choking up. Its 18-8 stainless parts stave off rust and corrosion. It resists wire-drawing and wear remarkably well. In fact, it stays on the job longer with less attention than any trap ever produced. Unless you live in Siberia, you can probably find a user around the corner who will tell you so from experience.

6. ***A trap should not be an "orphan".*** With Armstrong traps you can *always* get prompt service and parts from nearby Factory Representatives and stocking distributors as well as from the factory.

7. ***A trap should have a guarantee.*** The Armstrong trap is unconditionally guaranteed to give you *complete satisfaction* (as to doing its job, that is). If it doesn't, you can get your money back.

If you'd like to buy some of these excellent steam traps, call your local Armstrong Representative or write **Armstrong Machine Works, 8589 Maple St., Three Rivers, Michigan.**

ASK FOR the 44-page Steam Trap Book, free on request without obligation.

ARMSTRONG STEAM TRAPS

ROTARY PRECOAT FILTRATION

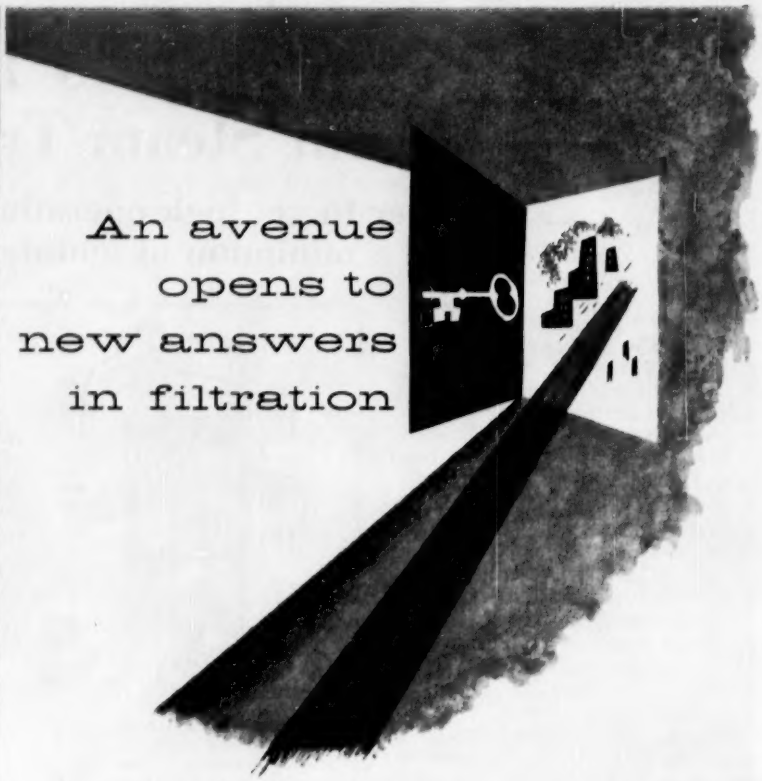
Although rotary precoat vacuum (and pressure) filters have become more and more a factor in filtration, there has been no test device available for the systematic study of filtration rates, filteraid requirements and all the other pertinent operating variables in precoat filtration. Test leaf filters have been used, it is true, but the lack of a precisely controllable shaveoff mechanism, among other things, has limited their usefulness and severely restricted the extension of their results to actual plant scale filtration. Full plant scale tests, though often impractical from the standpoint of time and expense involved, have hitherto been the sole method of working out, accurately, all the variables in establishing optimum performance of precoat filters at the lowest cost. Only those who have struggled with such a test can appreciate the tremendous difficulties in this work. Yet the potential savings in improved operations are so great that a solution of the problem has become imperative.



We believe that the newly-developed, laboratory-scale Dicalite Rotary Precoat Filter Test Leaf, described at the June meeting of the American Institute of Chemical Engineers, in Seattle, goes a long way toward such a solution. This device takes its place as a companion to the well-known Dicalite 'Bomb' Filter, developed earlier for studies in pressure filtration, and widely used for research and control in industrial plants, by filter manufacturers, and in the laboratories of industrial and university research groups.

The new Dicalite filter test leaf is already finding application in the determination of most efficient operating procedures for existing rotary precoat filter installations, and in studies to determine the possible advantages in potential applications. If you have problems involving rotary precoat filters, Dicalite field service engineers will be glad to advise with you, and to discuss the application of this new filter test leaf to the solution of these problems. Filter manufacturers' representatives will soon have this new Dicalite test unit to assist them in their work.

Paul W. Leppla, Technical Director



Filtration studies never possible before except on a pilot plant scale are now made quickly, inexpensively and more accurately through a new development of Dicalite research.

This device, a rotary precoat filter test leaf, is the first precise and practical laboratory-scale device available for study of the process variables in rotary precoat filtration. With it, complete tests of all the major variables can be made in a few hours with a few gallons of process liquor. A long series of these tests has demonstrated that the results obtained with the Dicalite Rotary Precoat Filter Test Leaf show close agreement with those subsequently obtained in full-scale plant operation.

Tremendous possibilities are thus opened up to processing people by this latest Dicalite contribution to the advancement of filtration technology.

For further information please write:

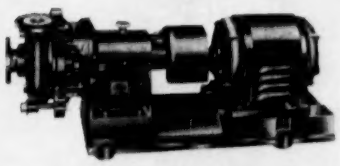
Dependable GLC GREAT LAKES Dicalite® DIATOMACEOUS MATERIALS

DICALITE DEPARTMENT, Great Lakes Carbon Corporation, 612 South Flower St., Los Angeles 17

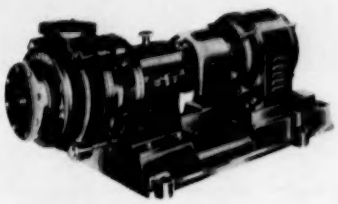
WILFLEY ACID PUMPS

LOW COST PUMPING

of Acids, Corrosives, Hot Liquids & Mild Abrasives



The new WILFLEY MODEL "AF" acid pump is famous for efficiency and dependability. Actual production-line records show worthwhile dollar savings in stepped-up performance and low-cost operation. Every day, in modern chemical plants the world over, WILFLEY Acid Pumps move hard-to-handle solutions on a trouble-free, round-the-clock schedule. Available in 5 to 3,000 GPM capacities with heads from 15 to 200′ and higher.



WILFLEY "AF" PACKINGLESS Acid Pump is available with wetted pump parts of any machinable alloy as well as plastics. This versatility of materials, as well as rugged heavy-duty construction and sound mechanical design, combine with the unique WILFLEY principles to make this an ideal pump for any corrosive service.

INDIVIDUAL ENGINEERING ON EVERY APPLICATION

A. R. WILFLEY and SONS, INC.

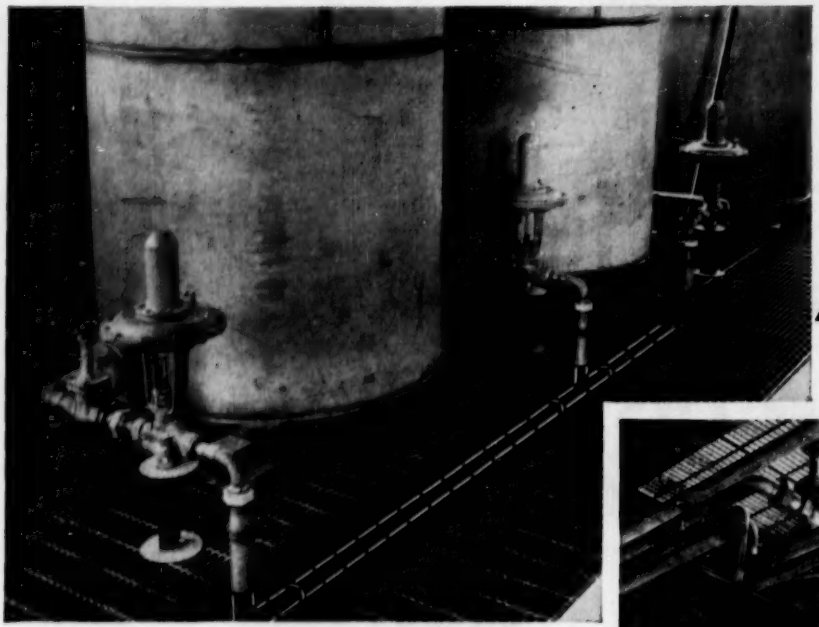
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Wilfley Sand Pumps
"Companions in Economical Operation"
Wilfley Acid Pumps

ENGINEERS SELECT

SPEEDLINE FITTINGS

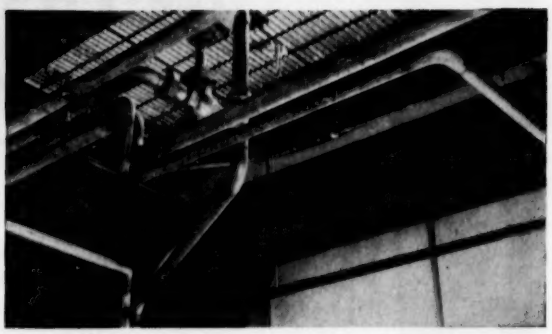
FOR COMPLEX STAINLESS STEEL PIPING SYSTEM



...TO PRODUCE ACROSS THE BOARD

SAVINGS

AT AMERICAN ALCOLAC CORPORATION



Speedline Fittings (tees, ells, reducers, etc.) cut costs, eliminated solvent leakage and provided greater line flexibility.

Piping extending through and running beneath the floor grating can be loosened and removed for alteration or repair, if required. This is important in an inflammable area at American Alcolac Corporation's Baltimore plant, where pipe welding must be done *outside* the plant now that process operations are underway. It's one of the assembly advantages which American Alcolac Corporation in conjunction with Marcus Sittenfield & Associates, consulting engineers, recognized in SPEEDLINE unions . . . and one of the reasons they specified SPEEDLINE Fittings for the plant's complete process piping system.

SPEEDLINE FITTINGS CUT COSTS and simplified installation across the board. Because SPEEDLINE unions, ells, tees, aligning connectors and reducers are designed especially for use with light wall pipe. Economical Schedule 5 stainless pipe was used to minimize materials costs . . . yet maintain high degree of process purity. Labor time and costs were reduced, too, because SPEEDLINE Fittings' exclusive "Tangential Feature" — an extra straight section on *every* end of *every* formed fitting—permits free choice of joining method to effect easier, faster assembly . . . even in constricted areas.

FACED WITH A PROCESS PIPING PROBLEM? Whatever your particular requirements, it will pay you to investigate the advantages of SPEEDLINE Fittings *first*. Write for a copy of "SPEEDLINE CATALOG" at no obligation . . . or contact your nearest SPEEDLINE distributor.



703

Speedline®

SPEEDLINE IS A REG. T.M. OF HORACE T. POTTS COMPANY

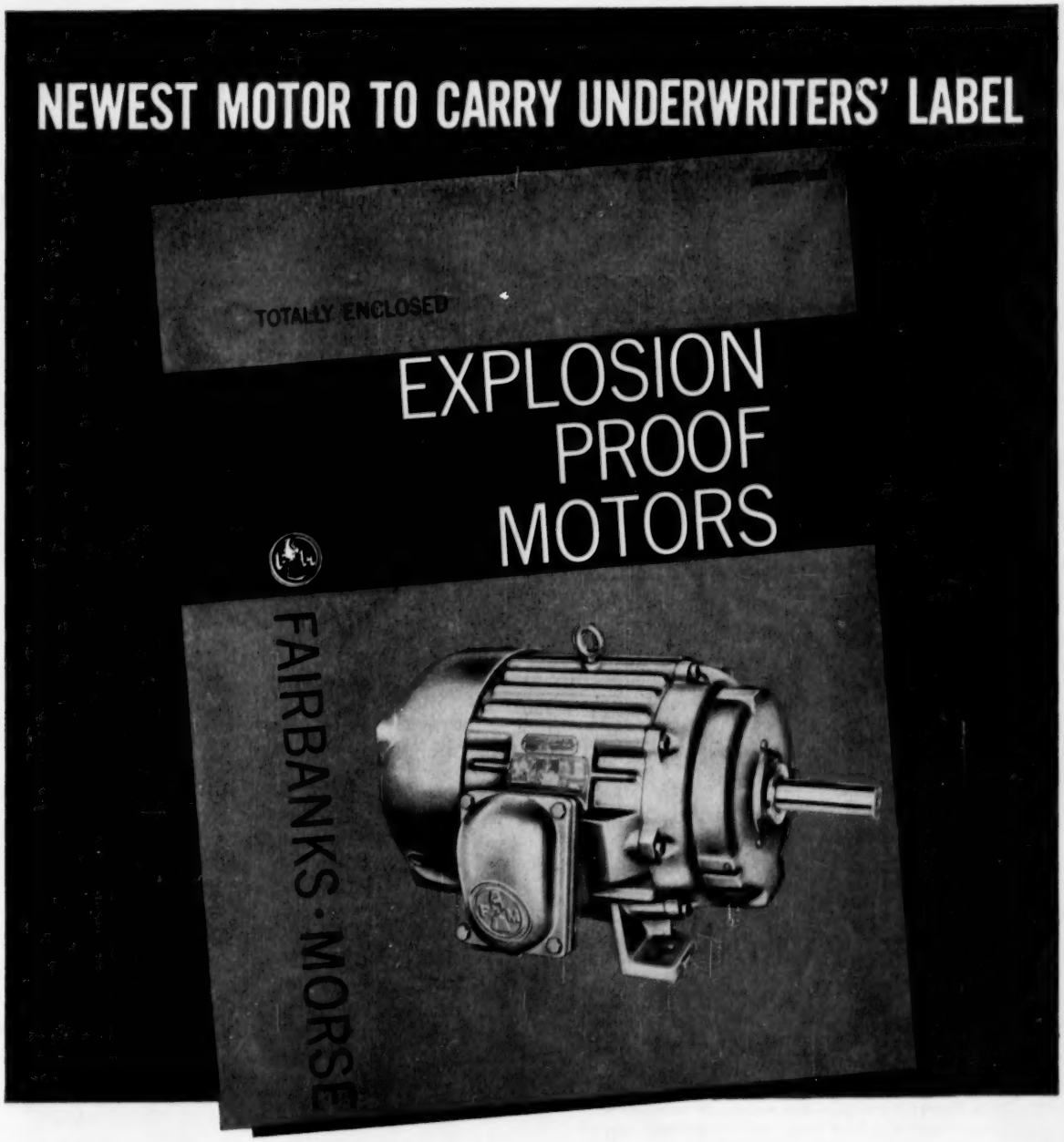
STAINLESS STEEL FITTINGS

THE NEWEST THING IN PIPELINE ECONOMY

SPEEDLINE DISTRIBUTORS ARE LOCATED IN PRINCIPAL CITIES FROM COAST TO COAST

Manufactured by **HORACE T. POTTS COMPANY** • 500 E. Erie Avenue • Philadelphia 34, Penna.

NEWEST MOTOR TO CARRY UNDERWRITERS' LABEL



FAIRBANKS-MORSE

EXPLOSION PROOF

All new inside and out—new, rugged frame design . . . for new, improved performance in all Class I, Group D, and Class II, Group E, F and G hazardous locations.

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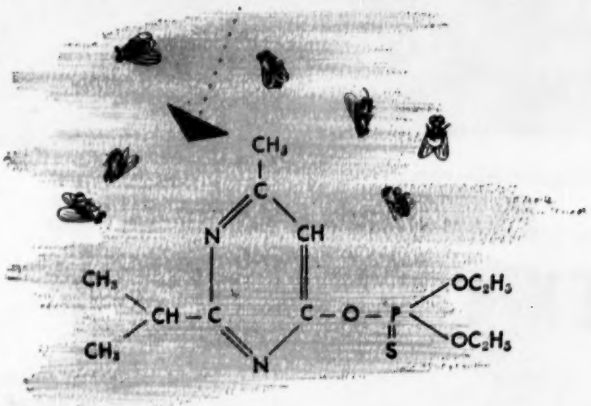
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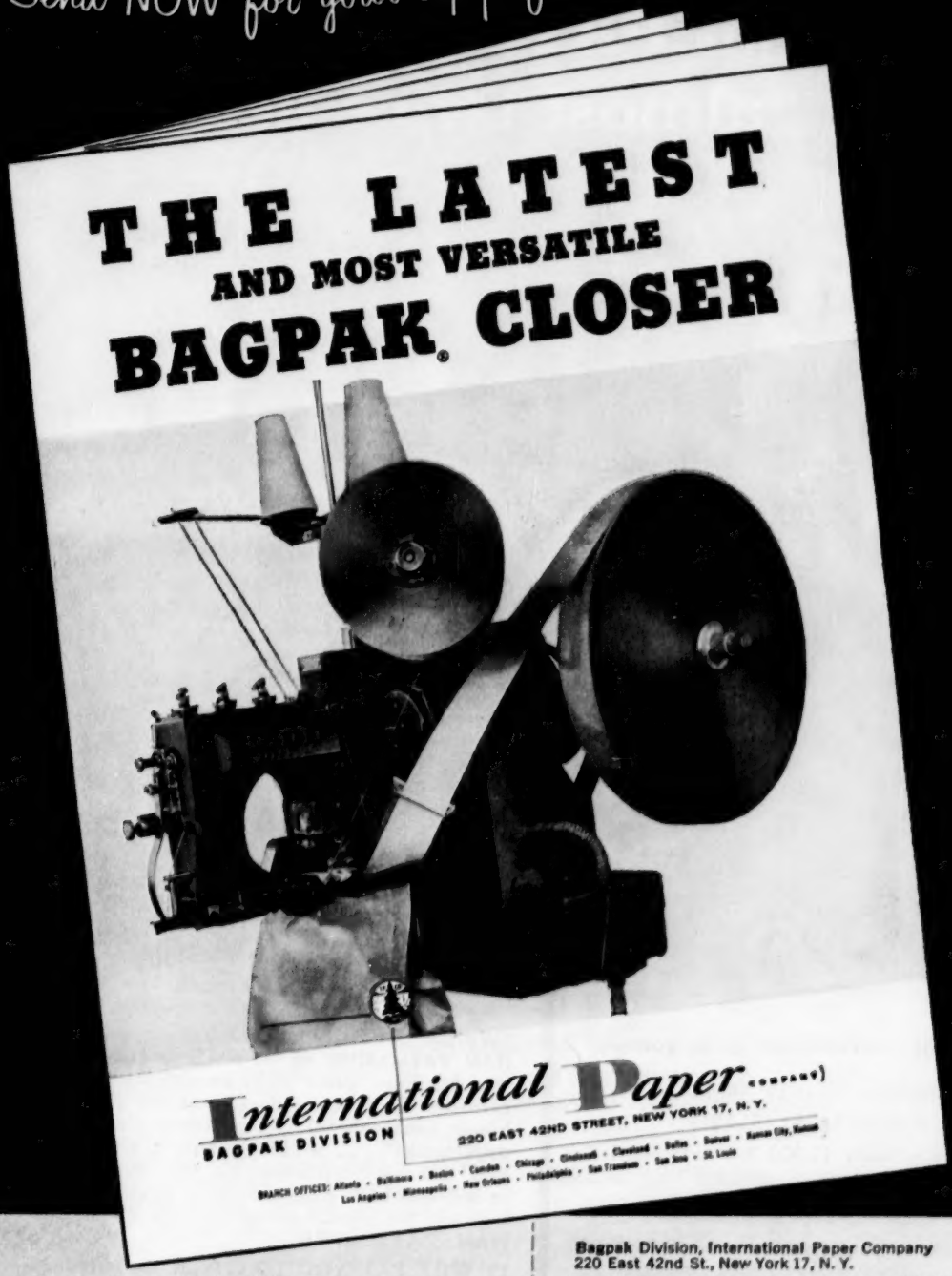


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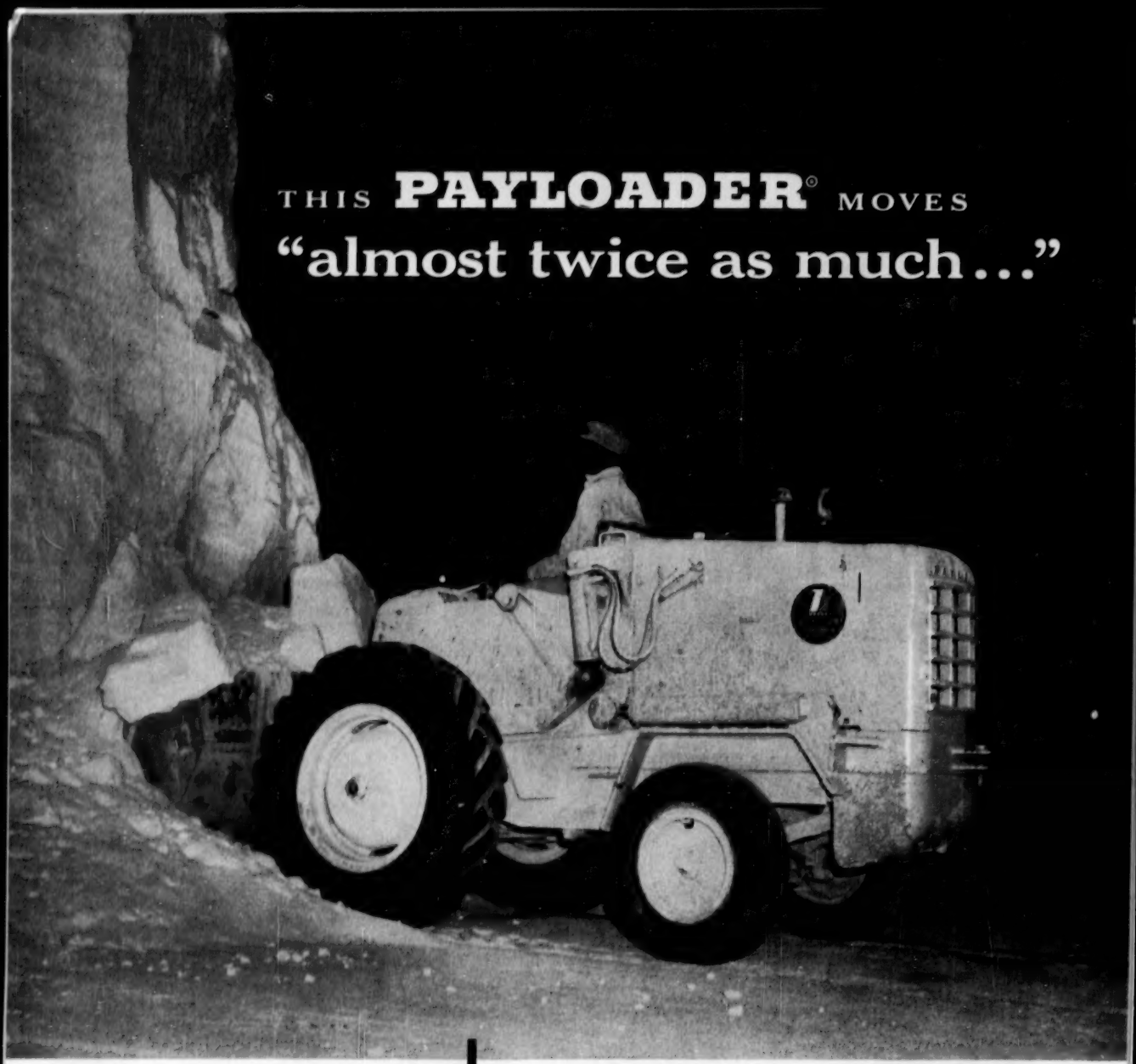
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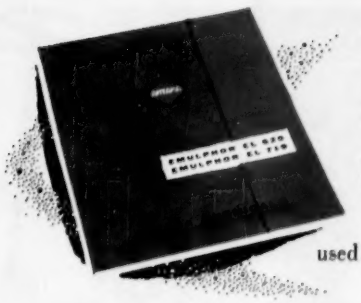
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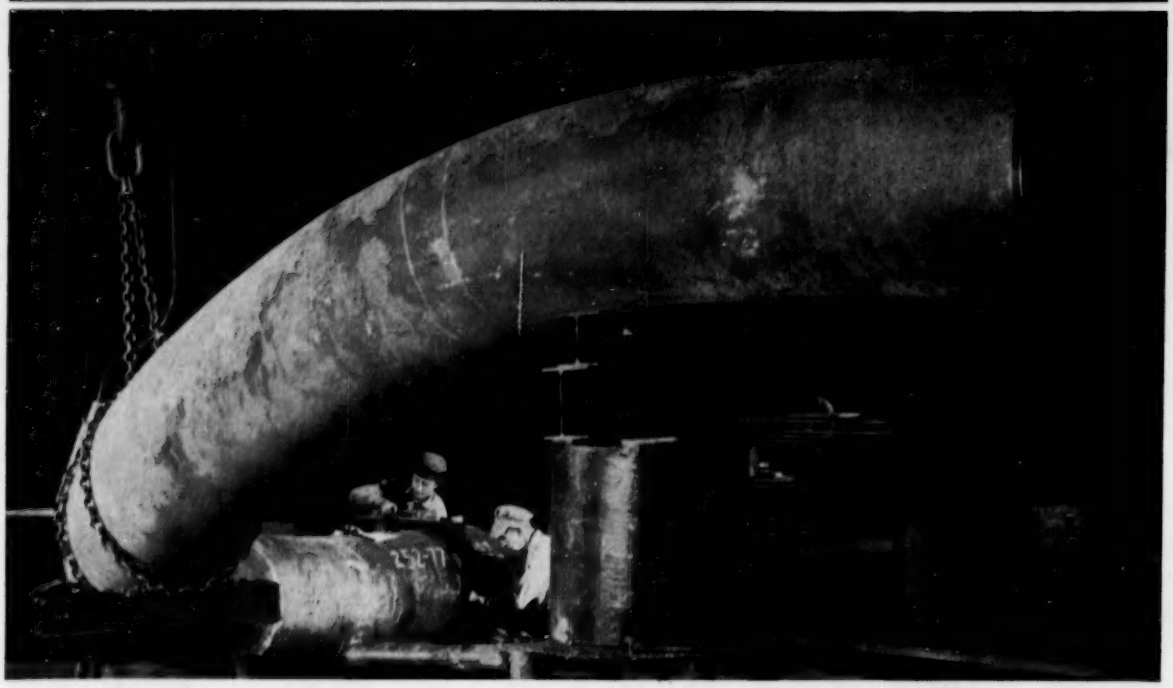
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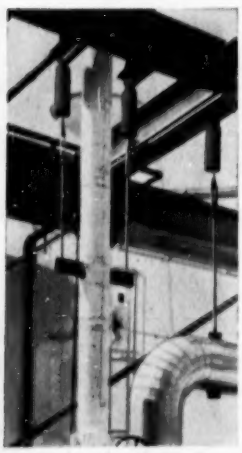
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A new Blaw-Knox "6 x 6" Flexibility Matrix Method of computing stresses in power piping systems is now available to consulting engineers, companies, and individuals responsible for the design of power piping systems. By the use of an electronic computer this method cuts calculating time from months to a day; assures full accuracy to six significant figures; and has no limitations on the complexity of the system. Write for further information about our new "6 x 6" Flexibility Matrix Method.



Two-way control over movement of piping is provided by Blaw-Knox functional spring hangers with the patented internal swivel action—shown in this modern outdoor generating station. Our experienced engineers are available to both design and make recommendations for your hanger requirements. To get full information, write for Catalog No. 54.

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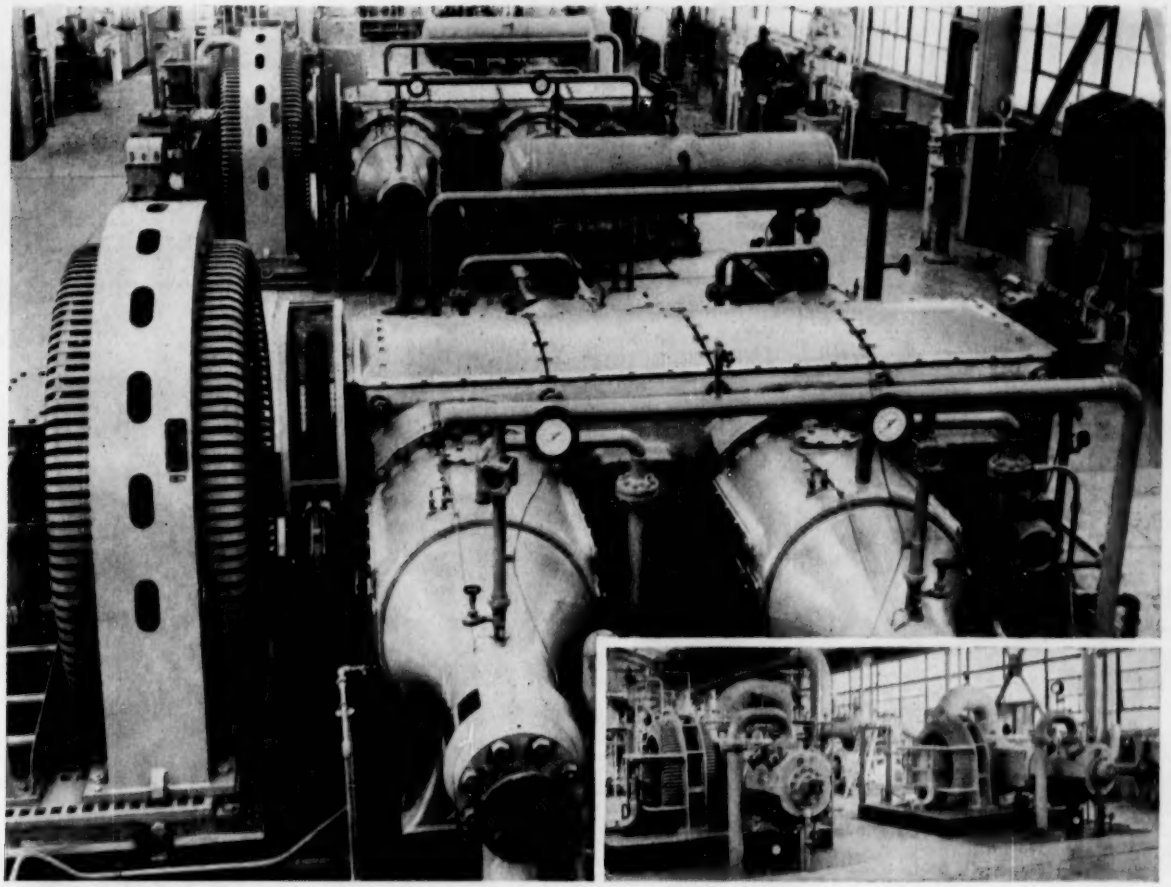
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Cooper-Bessemer 2-cylinder FM's compressing ammonia at the Tuscola plant of U. S. Industrial Chemical.

Two 1500 hp motor-driven JM compressors handling compression of synthesis gas, before conversion to ammonia.

In Ammonia Service for U.S.I....

high efficiency Cooper-Bessemer Compressors

This installation at the Tuscola, Illinois plant of U. S. Industrial Chemical Co., a division of National Distillers and Chemical Corp., is typical of the many processing plants using reliable Cooper-Bessemer compressors.

Here, two 4-cylinder JM compressors, each rated 1500 hp, handle compression of synthesis gas; and two 2-cylinder FM compressors, each rated 300 hp, handle the compression of ammonia.

These modern, natural force balance Cooper-Bessemers retain the long-life qualities of much larger slow speed units. The M-Line is exceptionally compact without sacrificing accessibility or ruggedness. They conserve valuable space, reduce over-all installation time, and require less investment in foundations and piping.

Available from 200 to 6000 horsepower, each M-Line compressor unit is engineered to meet specific requirements with extreme efficiency and at the lowest possible cost. The nearest Cooper - Bessemer office will gladly furnish detailed information.

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THE DEMPSTER DUMPSTER® SYSTEM





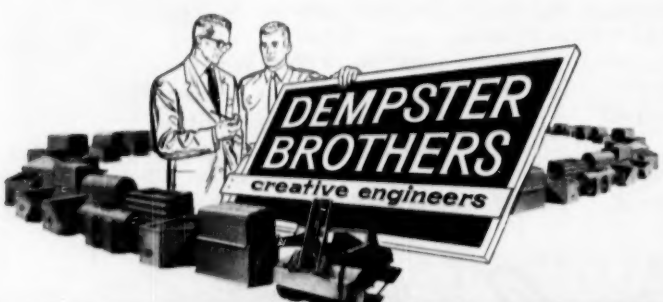


Also noted for its plant-wide cleanliness and sanitation, Armour and Company handles bulk materials at its Fort Worth operation with the aid of Dempster-Dumpster System. In addition to the fire hazards, the unsanitary waste material accumulation and collection with conventional methods, the high cost of handling constitutes a further problem for most manufacturers. Thousands of users like Armour and Company have found the Dempster-Dumpster System helps to solve all of these problems. Above you see how each big Dempster-Dumpster Detachable Container is serviced by the truck-mounted Dempster-Dumpster, operated by only one man, the driver. At right you see other collection jobs handled at the Armour plant by a few of the hundreds of different designs and sizes of containers available. There is a Dempster-Dumpster Detachable Container available or that can be built to suit the material — be it solid, liquid, dusty, combustible, high temperature . . . waste or salvable, raw or finished product, and each, regardless of size up to 21 cu. yds. or capacity up to and over 36,000 lbs. payload, can be handled by one truck-mounted Dempster-Dumpster with only one man, the driver! Savings are tremendous! Write us today for complete information. *Manufactured by Dempster Brothers, Inc.*



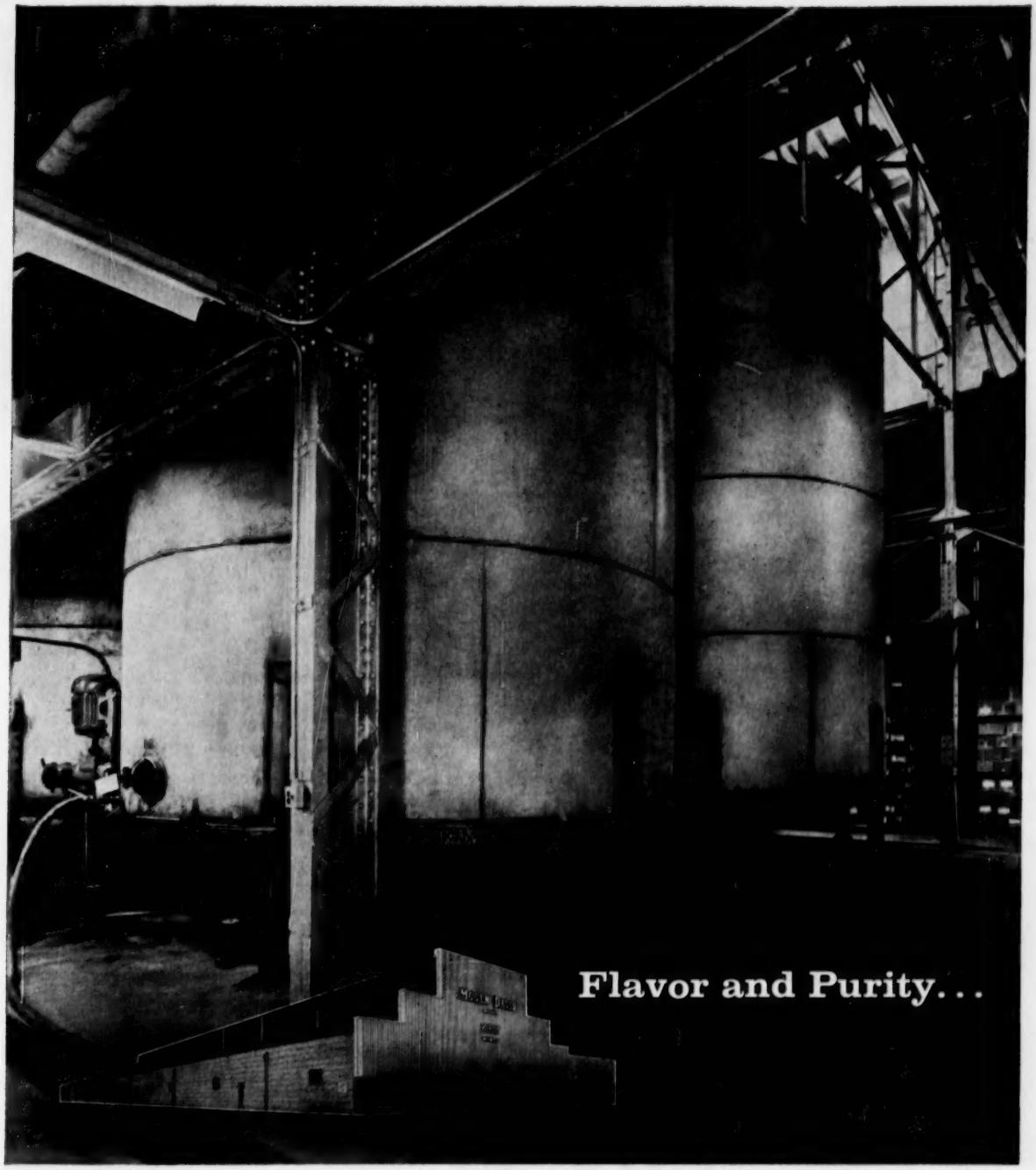






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Half a million gallons of Mogen David Wine Corporation's popular Key wines are blended and stored in 15 stainless tanks site-erected by Graver at Chicago's newest winery. Graver crews erected four tanks, 18'6" diameter x 28'6" high, and eleven tanks, 14' diameter x 18'3" high, all of Type 304 stainless steel. By the selection of stainless steel, the distinctive flavor of 3 entirely different Key Wine brands is maintained consistently during storage and blending. If flavor and purity are factors in your product, be sure to consult with Graver engineers.

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LITHIUM Hydroxide Monohydrate

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USES for $LiOH.H_2O$ are many. Do these suggest a new use to you?

As an **additive:** Rubber treated with the stearate of lithium provides internal and external lubrication and a low coefficient of friction.

As an **emulsifier:** In the manufacture of porous concrete, $LiOH.H_2O$ is used as an emulsifying agent.

As an **absorbent:** In anhydrous form it's the most efficient solid material known for the absorption of carbon dioxide.

As a **stabilizer:** Silica sols stabilized with $LiOH.H_2O$ are used for the catalytic preparation and treatment of leather, paper and textiles, and the preparation of phosphors and phosphor adhesives.

As a **thickener:** Grease, soap and wax-makers rely on $LiOH.H_2O$ as a gelling agent.

As a **substitute:** As a substitute $LiOH.H_2O$ is used in pharmaceutical and chemical manufacturing where the use of lithium carbonate is not feasible.

As a **booster:** It's indispensable in the electrolyte fluid of alkaline storage batteries where it greatly increases battery capacity and efficiency.

As a **catalyst:** In the preparation of alkyd resins it's a preferred polymerization catalyst, and a highly active catalyst in esterification reactions.

Why don't *you* look into the versatility of lithium hydroxide monohydrate? Our PR&D department has product data and samples for the asking.

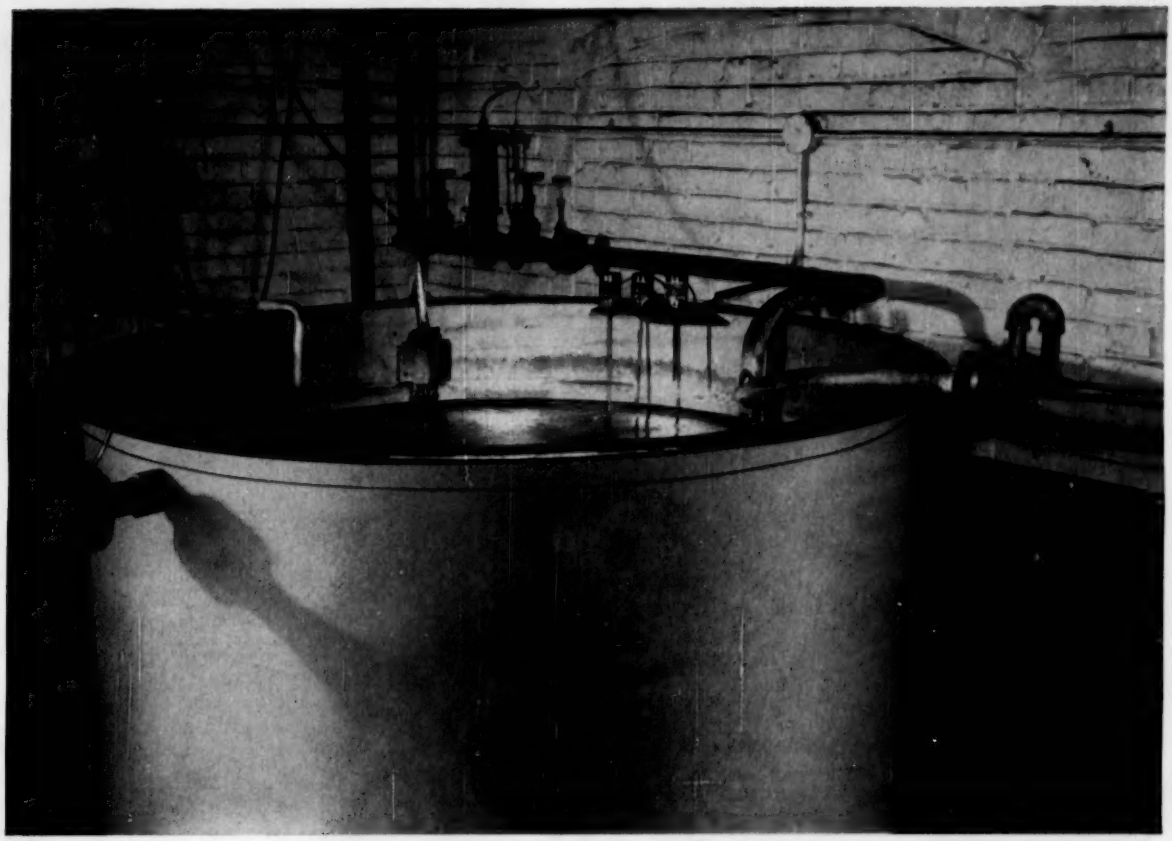
... trends ahead in industrial applications for lithium

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Another plant tames sulphuric acid with *Carpenter* Stainless No. 20 and No. 20Cb

An automatic sulphuric acid dilution system, with Carpenter Stainless No. 20 and No. 20Cb preventing corrosion at critical points, is cutting acid costs and reducing dangerous acid handling for a Tennessee textile plant. Savings with the system in its first year of operation equaled the total initial cost. Carpenter No. 20 and No. 20Cb control corrosion attacks of H_2SO_4 concentrations up to 23% in a cutting tank (shown above), piping and pumps.

Whether you have sulphuric acid solutions or other strong corrosives to handle, see how Carpenter Stainless No. 20 and No. 20Cb can help you cut corrosion costs by keeping acid handling equipment on the line longer.



Write for a copy of the Carpenter Stainless No. 20 and No. 20Cb handbook containing physicals, corrosion resistance and fabrication data.

These super corrosion-resistant alloys are available in tubing, pipe, sheet, plate, bars, strip, wire and billets to meet your exact requirements.

See your nearest Carpenter Distributor for full information and help on your particular application for Carpenter Stainless No. 20 and No. 20Cb.

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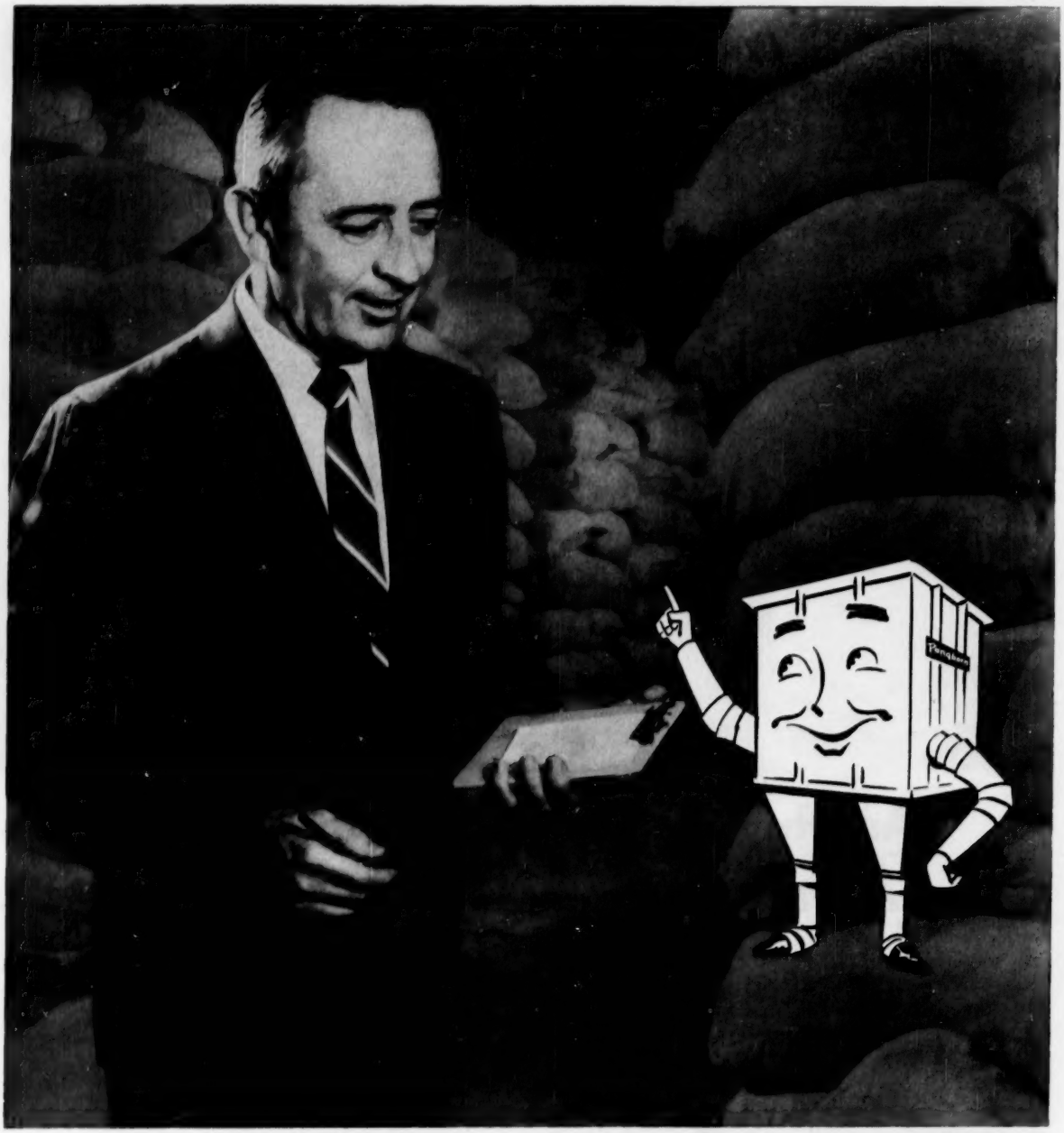
The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

Export Dept.: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

Carpenter

Stainless No. 20 & No. 20Cb

Carpenter No. 20 bars, strip, wire and billets are available also from The Carpenter Steel Company, Reading, Pa.



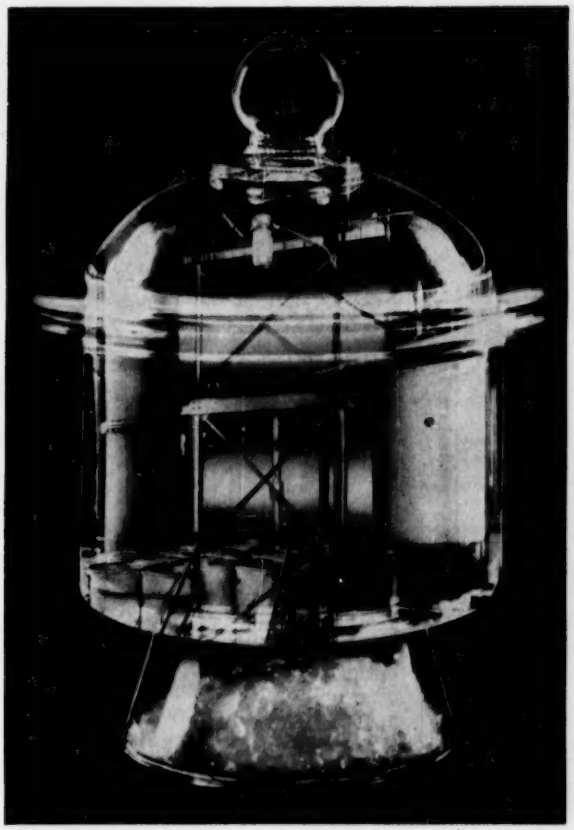
"You mean $15,000 a year salvaging dust?"

That's just what we mean! Many of our customers are clearing $15,000 a year and more from valuable material reclaimed by Pangborn Dust Control. Efficient Pangborn Dust Collectors trap dust at the source, gather it ready for resale, re-use or disposal. As a matter of fact, users of Pangborn Dust Control have made $20,000, $36,000, even $75,000 a year in salvaged dust, depending on the value of the dust collected.

What's more, Pangborn gives you other benefits of lower housekeeping costs, longer machinery life, higher employee efficiency and better employee and community relations. And Pangborn offers a complete line of collectors for all jobs.

Why not discover how you can profit from Pangborn Dust Control? Write for Bulletin 922 to PANGBORN CORP., 2600 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control & Blast Cleaning Equipment.*

Pangborn CONTROLS DUST





Extract all water from the system?

Put Inco Nickel in critical zones?

Which is the easier way to cut your losses from corrosion of chlorinated solvent equipment?

Keep your processing or recovery system free of moisture . . . operate it at atmospheric temperature . . . and you are not likely to have trouble from corrosion when handling chlorinated solvents.

But how often is it practical to keep trace water out . . . or take it out once in? And how do you prevent major variations in temperature that cause condensation?

It's easier by far to put Inco Nickel in critical zones

Easier . . . and in the long run . . . least expensive. Experience in a large number of installations shows two reasons for this.

First, the dilute HCl formed by decomposition of the solvent-water mixture or vapor attacks nickel much less readily than steel.

Second, there is less hydrolysis of the solvent in nickel equipment than in steel and less formation of the HCl that causes the corrosion.

These two effects combine to keep the corrosion rate of nickel in most chlorinated solvents to negligible proportions . . . a fact that has enabled many to greatly increase equipment life.

A large eastern producer, for example, uses Inco Nickel for CCl_4 purifying stills, for reboilers of primary separation stills, for chlorinator coolers, for neutralizers (where distillate is washed with caustic), for condenser coils. At present, they are putting in a nickel shell-and-tube heat exchanger for cooling CCl_4 liquor.

The experience of other companies and the results of laboratory work on this subject are included in Inco's Technical Bulletin T-29. May we send you a copy?

The International Nickel Company, Inc.
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INCO

Inco Nickel... *for low maintenance*

Is Industry Creating A New Breed of "Bonus Babies"?

THE STARTING SALARIES offered to this year's June graduates give the impression that industry is creating a new breed of "bonus babies." This is the term baseball fans apply to sturdy youngsters whose talent for hitting and throwing gets them payments of up to $100,000 and other benefits for signing a contract.

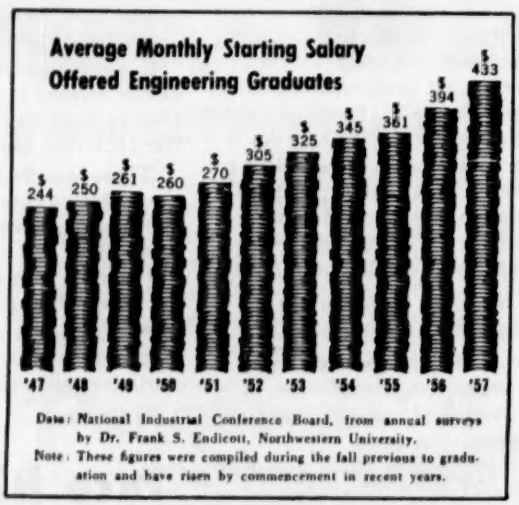
For several years industry's demand for young college graduates, especially in science and engineering, has outrun the number receiving degrees. Competition for these young people has steadily pushed up the starting salaries and has induced many companies to indulge in lavish recruiting programs. This year engineering graduates are being offered well over $400 a month, and even liberal arts graduates find numerous offers at $400 or more. Only ten years ago the salaries offered senior engineering students averaged less than $250 a month.

But any employer who assumes that high starting salaries alone will assure him the number of June graduates he wants is likely to be disappointed. A recent study by the McGraw-Hill Classified Advertising Division shows that most young engineers and scientists going into industry are more interested in their opportunities and in a company's future than they are in the size of their first paycheck.

Money Isn't Everything

In the McGraw-Hill survey, 2,596 recently-hired engineers and scientists employed in 57 companies listed the factors they had considered before accepting a position. The replies of the younger engineers and scientists—those with less than five years' experience — have great significance for employers who want to make any impression in the highly competitive market for college graduates.

- **Potential growth of the company** was listed by more young engineers and scientists than any of the 42 other items on the list as a factor that influenced greatly their decision in accepting a position.
- **Challenging opportunity** was second.
- **The company's prestige and reputation** ranked third.



Data: National Industrial Conference Board, from annual surveys by Dr. Frank S. Endicott, Northwestern University.
Note: These figures were compiled during the fall previous to graduation and have risen by commencement in recent years.

● **Progressive research and development program** was fourth.

● **Starting salary** ranked only **seventh.**

Job and Future Most Important

As a group, the factors relating to the nature of the job, its future and the company's future had by far the greatest influence in attracting young engineers and scientists to their present positions. These include three of the top four attractions—potential growth of the company, a challenging opportunity and a progressive research and development program. Other factors in this group are the company's facilities, quick advancement, self-direction or little supervision, chance to work in a certain field, small size of company and rewards for individual accomplishment.

The second most important group of attractions had to do with prestige. These include the company's prestige and reputation, executive or professional standing and association with leading men in the field. **Third in importance were financial considerations** — starting salary, regular salary increases, financing of relocation, paid vacations and holidays.

A less important group of factors influencing young scientists and engineers were essentially social. Geographic location and educational facilities in vicinity ranked fairly high. But recreational facilities, suburban or country living, pleasant housing and cultural considerations had little appeal.

Ranking lowest, by a good margin, were factors having to do with security—permanent position; health, life and surgical insurance; retirement or pension plan; and sick leave.

It is interesting to note that some of the factors which influenced the **smallest** percentage of young engineers and scientists were country club memberships, use of company car, at-cost or low-cost eating place, travel opportunities abroad and being able to buy the company's products at a discount.

A Lesson For Employers

The lesson of this survey to employers who hope to recruit more young engineers and scientists is clear. High salaries and other financial appeals are important. But, **at a time when high starting salaries are offered in abundance, our young graduates are interested even more in being with companies that will grow and in jobs that will permit them to grow. They are interested in jobs that offer opportunities for advancement, financially and professionally.**

* * *

Were the young scientists and engineers who participated in the survey trying to impress somebody with their motives? If so, it could only have been to impress themselves, for all were asked to return their questionnaires unsigned.

What Factors Influence the Job Selections of Young Engineers and Scientists?

Factors Influencing Decision Greatly	Percent Listing Factor
Potential growth of company	55%
Challenging opportunity	53
Company's prestige, reputation	44
Progressive research and development program	41
Geographic location	37
Permanent position	35
Starting salary	34
Educational facilities in vicinity	33
Regular salary increases	31
Chance to work on specific project, or in certain field	27
Company's facilities (laboratories, technical libraries, etc.)	25
Tuition for graduate study	25

Based on replies by recently-hired engineers and scientists with less than five years' experience to questionnaire distributed by McGraw-Hill Classified Advertising Division.

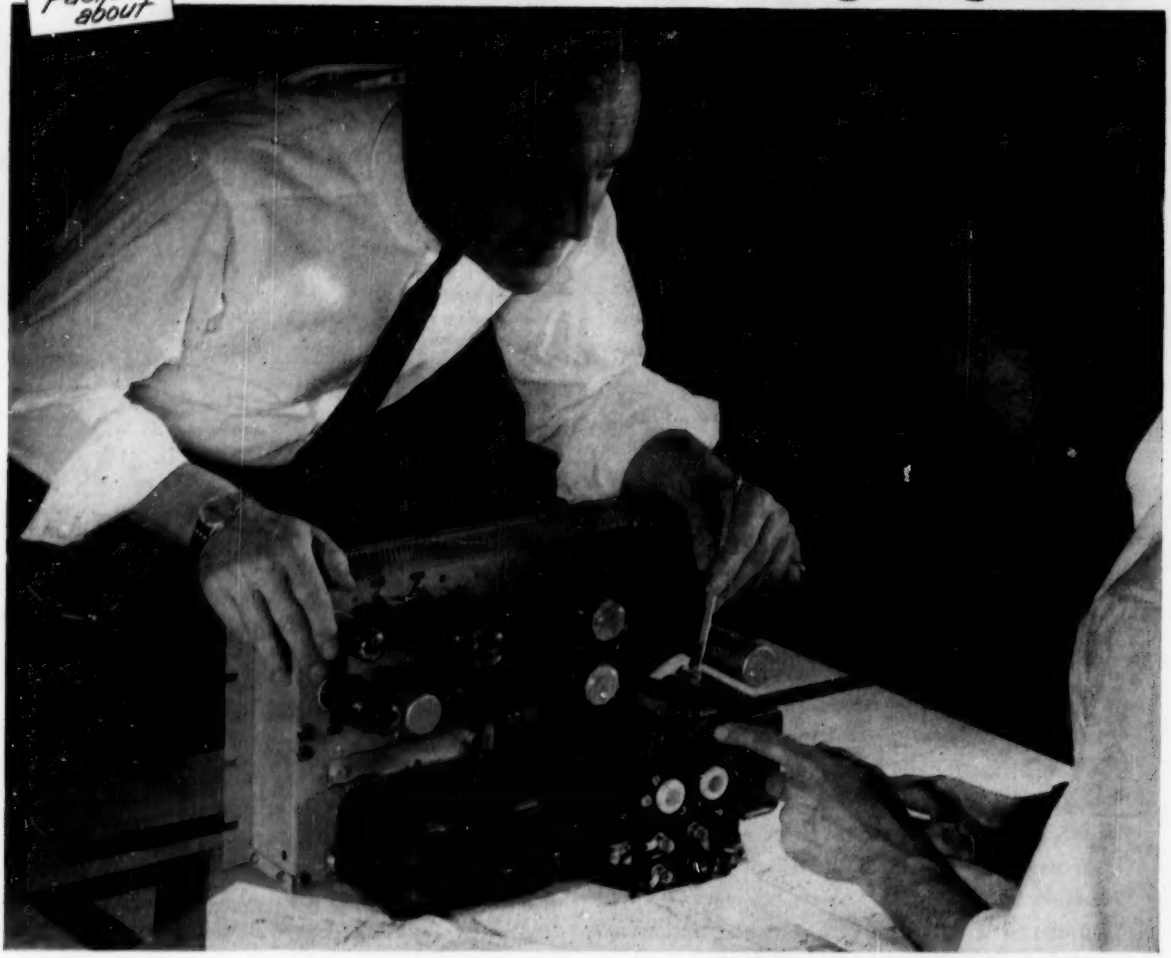
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Donald C. McGraw
PRESIDENT

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STABILINE® *Automatic* Voltage Regulators



STABILINE type IE (Instantaneous Electronic) is available in 115 volt units — input range from 95-135v. and 230 volt units — input range from 195-255v. STABILINE type IE5101R shown above.

"Here's how to Build-in Automatic Voltage Regulation"

"No matter how good your control instrumentation is, it is not going to be precisely accurate at all times unless the input voltage is precisely *constant*.

"You just can't get better automatic voltage regulation equipment than with this STABILINE. At no load, full load or any intermediate stage it maintains constant *output* voltage regardless of line fluctuations.

"This sensitive, yet ruggedly constructed, automatic voltage regulator is a must component in today's voltage sensitive apparatus."

Three types of STABILINES are available for individual needs:

Type IE (*Instantaneous Electronic*) is completely electronic, instantaneous in action, with no moving parts. Constant output voltage is maintained regardless of line or load fluctuations.

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Using Salt Efficiently

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt



"Volumetric Dilution" Assures Highest Accuracy in Brine Make-Up

For years, the process of making dilute brine has required careful manipulation, frequent salometer readings, and close supervision. Today, however, dilute brines of any strength whatever can be made up quickly and accurately, by means of a system which gives consistently dependable results. This system, which uses International's Lixate Equivalent formula, is known as "Volumetric Dilution." It needs no trained technicians, a minimum of attention, and no salometer readings.

How "Volumetric Dilution" works. Since a dilute process brine can be considered a mixture of fully saturated brine and pure water, it is necessary in each case to know the ratio between these two components. This ratio can be quickly determined by means of International's Lixate Equivalent—which is essentially the amount of fully saturated brine needed to bring water to a brine of correct salometer reading.

The first step, after determining how much finished brine is needed, is to indicate this amount on the tank wall with a simple marker (cleat, nail, paint, etc.). Then, with International's Lixate Equivalent formula, the exact amount of 100%-saturated brine needed for the finished brine mixture is quickly computed. A second marker is then placed to indicate this lower level, and the tank is ready for the brine-dilution operation. Fully saturated brine is poured up to this lower tank marker, and water is added until the liquid level reaches the top marker.

For example: a tank is to hold a 10-ft. depth of 60° S. brine. To find exactly how much fully saturated brine should first be poured into the empty tank, the desired finished brine depth (10 ft.) is multiplied by the Lixate Equivalent (which, for 60° S. brine, is 0.5570). Answer: 5.57. In other words, fully saturated brine must be poured to a level 5.57 ft. above the tank bottom. When water is added to the 10-ft. level, the result is a supply of 60° S. brine.

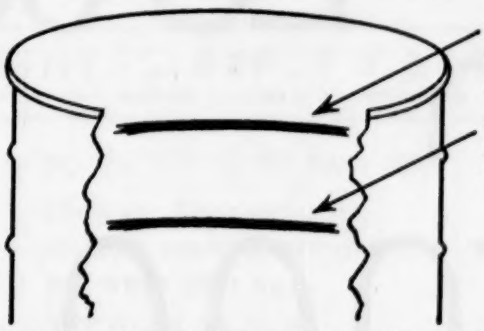
International's Lixate Equivalent formula works equally well when brine volume is measured in gallons. If a tank is to hold 500 gallons of finished brine, the amount of fully saturated brine needed is 278.5 gallons (500 x 0.5570). This amount of fully saturated brine when mixed with water, will make 500 gallons of 60° S. brine.

This system of "Volumetric Dilution" can be put into operation quite simply: 1. There must be a supply of 100%-saturated brine (which is made automatically in the Sterling Lixator). 2. The brine make-up tank, whatever its cross-sectional shape, must have vertical walls, so that the horizontal area remains constant. 3. Liquid level marks are needed on the tank walls.

Two of these requirements are part of every Lixate Brine-Making Installation. A supply of fully saturated brine is always on hand in the Lixator, and dilute brine can be made up in any existing brine storage tank. Thus the only necessary additions are the brine-depth markers on the tank wall.

"Volumetric Dilution," which gives such positive accuracy for such little time and effort spent, will work *only when the brine used is 100%-saturated.* If the brine is, for example, 95%-saturated, the Lixate Equivalent formula won't apply, and the finished brine won't have the desired strength.

There is a Lixate Equivalent for every salometer reading of dilute brine—from 1° S. (Equivalent 0.0083) to 99.6° S. (Equivalent 0.9945). To get Lixate Equivalent data, simply contact International. No cost or obligation.



Cutaway view of tank ready for accurate brine make-up with "Volumetric Dilution"

The most effective brine for accurate "Volumetric Dilution" is Lixate Brine—always fully saturated, always crystal-clear. This brine is made automatically, and self-filtered automatically, in the Sterling Lixator. The Lixator, which needs no attention, also stores both salt and brine. It is widely used today in plants of every type. There are many different kinds of Lixator installations—Storage Lixators, Silo Lixators, Sterling Model Lixators—in different designs and sizes to suit any plant layout.

TECHNICAL SERVICE WITH YOUR SALT

Through skilled and experienced "Salt Specialists," International can help you get greater efficiency and economy from the salt you use. International produces both Sterling Evaporated and Sterling Rock Salt in all types and sizes. And we also make automatic dissolvers in metal or plastic for both kinds of salt. So we can recommend the type and size of salt most perfectly suited to your needs.

If you'd like the assistance of an International "Salt Specialist" on any problem concerning salt or brine—or further information on "Volumetric Dilution"—just contact your nearest International sales office.

International Salt Co., Scranton, Pa.

Sales Offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa; and Richmond, Va.

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Let's face it... the threat of war and the atomic bomb has become a real part of our life—and will be with us for years. Fires, tornadoes and other disasters, too, can strike without warning.

Whatever the emergency is, everybody's going to want help at the same time. It may be hours before outside help reaches you. The best chance of survival for you and your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. Disaster may happen TOMORROW. Take these simple precautions TODAY:

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here, again, your CD Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First-Aid Training Courses. They may save your life.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads and official CD films or literature that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

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2	36j	75	111	155	184C	198B	220-1i	334	364	387	419f	464	470Ex	477G	483E	493	499G		
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7	36l	77	113	155b	184E	198D	220-1k	338	366	391	419h	465a	471	478	484	494	B500		
9	36m	78	114	155c	184F	199	220-1l	339	367	392	419i	465b	471A	478A	484A	494A	500A		
10	36n	79	115	155d	184G	200A	222	340	368	393	420	465c	471B	478B	484B	494B	500B		
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12	40-1	81	116a	155f	184Hb	200C	224	340b	370	398	422	465e	471D	478D	485A	495	500D		
13	40-1a	82	116b	155g	184I	200D	225	340c	370a	399	423	466	472E	478	486	495A	500E		
14	40-1b	83	117	155h	184J	200E	230	340d	370b	400	424	466A	472A	478F	486A	495B	500F		
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16	44-5	85	118a	159	185	202A	232	341a	370d	402	426a	466C	472C	479A	486C	496A	L501		
17	46-7	86	118b	161	186A	202B	234	341b	371	403	426b	466D	473	479B	486D	496B	TR501		
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20-1	56-7b	93	123	174-5	191	209	299	347	378	410a	435	467D	474	481B	487C	497D	R504		
24-5	56-7c	94	124	176A	192A	211	301	348	379	410b	436	468	474A	481C	487D	497E	L505		
26	56-7d	95	125	176B	192B	212	303	349	380	410c	437	468A	474B	482	488	497F	R505		
30-1	58-9	96	126	177	192C	212a	305	L350	381	410d	438	468B	474C	482A	488A	T498	T506		
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34	60-1a	98	129	178B	192E	213	309	352	381b	411	442	468D	475	482C	489A	498A	TL507		
35	60-1b	99	130	178C	193	214	311	353	381c	412	444	468E	475A	482D	489B	498B	TR507		
35a	60-1c	100	130a	178D	194A	215	313	354-5	381d	413	444a	468F	475B	482E	490	498C	BR507		
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35c	62-3	102	130c	180A	194C	218	317	356a	381f	415	444c	469A	476A	482G	490B	498E	B508		
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36d	71	103-4a	138	182A	196B	220-1c	327	360	382	419a	450	470A	477B	483	491C	499B	TR510		
36e	71a	105	143	182B	196C	220-1d	329	360a	383	419b	455	470B	477C	483A	492	499C	B510		
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REPRINTS: Circle what you want. See p. 508 for descriptions.

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Important—For pages showing more than one advertised item, use this guide to numbers on cards above.

18 Both items discussed
- 18a Valves, sliding gate; Bul. J-160
- 18b Joints, swing; Cat. F-8

19 Both items discussed
- 19a Pipe, rigid
- 19b Sheet, polyvinyl chloride

35 All items discussed
- 35a Polish, zinc
- 35b Titanium
- 35c Organosodium compound

36 All items discussed
- 36a Sodium dispersions
- 36b Containers, polyethylene
- 36c Resins, polyethylene
- 36d Adhesives
- 36e Tubing, Titanium
- 36f Baffle, remote control
- 36g Rust Remover
- 36h Zirconium & hafnium
- 36i Paint, vinyl
- 36j Solvents & Organometallics
- 36k Plastics extender
- 36l Recorder, Water vapor
- 36m Manipulator, tubing
- 36n Detector kits, vapor

40-1 Measurement & control equipment
- 40-1a Valves
- 40-1b Gages, pressure

56-7 All items discussed
- 56-7a Dryer-blenders
- 56-7b Nozzle, agitating
- 56-7c Steel, glassed
- 56-7d Outsert applicators

60-1 All items discussed
- 60-1a Process pipe, aluminum
- 60-1b Heat exchangers, aluminum
- 60-1c "Reynolds . . . Vessels"
- 60-1d Fencing, aluminum

102 All items discussed
- 102a Pumps, double suction
- 102b Pumps, single suction
- 102c Pumps, multistage

103-4 All items discussed
- 103-4a Heat exchangers bul.

116 Both items discussed
- 116a Coatings
- 116b Linings, tank

118 All items discussed
- 118a Mixers, tank top
- 118b Mixers, side entering
- 118c Mixers, portable & tripod
- 118d Mixers, pipeline

130 All items discussed
- 130a Mills, colloid
- 130b Homogenizers, laboratory
- 130c Homogenizers & dispersers

155 All items discussed
- 155a Mixers, Cat. B-102
- 155b Mixers, Cat. B-103
- 155c Mixers, portable
- 155d Mixers, side entering
- 155e Mixers, laboratory
- 155f Mixers, fluid
- 155g Seals, mechanical, rotary
- 155h Mixers, Bul. B-107

184Ha Titanium sponge

184Hb Titanium mill products

212 Both items discussed
- 212a Box car pullers
- 212b Winches

220-1 All items discussed
- 220-1a Soda, caustic, liquid
- 220-1b Caustic soda, flake & solid
- 220-1c Phosphorus oxychloride
- 220-1d Phosphorus trichloride
- 220-1e Sodium sulfhydrate
- 220-1f Potash caustic
- 220-1g Sodium sulfide
- 220-1h Potassium chlorate
- 220-1i Potassium perchlorate
- 220-1j Sodium chlorate
- 220-1k Acid, oxalic
- 220-1l Chemicals, Bul. 100-A

340 All items discussed
- 340a Pipe, plastic
- 340b Pipe, hard rubber
- 340c Pumps, acid
- 340d Valves, swing check

341 All items discussed
- 341a Linings & coverings, rubber
- 341b Valves; Bul CE-52
- 341c Steels, rubber-lined
- 341d Pails, acid

356 Both items discussed
- 356a Blenders, liquid-solids; Cat. 14
- 356a Blenders, liquid-solids; Cat. 15-A

360 Both items discussed
- 360a Controls, temperature; Bul. 3-1
- 360b Controls, temperature; Bul. 3-5

370 All items discussed
- 370a Linings, tank
- 370b Cements, corrosion proof
- 370c Coatings, protective
- 370d Plastic structures, rigid

381 All items discussed
- 381a Agitators & mixers
- 381b Mills, ball
- 381c Samplers, automatic
- 381d Crushers, jaw
- 381e Feeders, wet reagent
- 381f Filters, disc
- 381g Flotation
- 381h Tables, concentration
- 381i Laboratory equipment
- 381j Dryers

410 All items discussed
- 410a Crushers, rotary fine
- 410b Crushers, jaw
- 410c Mills, ring roll
- 410d Mills, hammer
- 410e Rolls, crushing

419 All items discussed
- 419a Mixers, side entering
- 419b Dry blenders & ribbon mixers
- 419c Mills, ball & pebble
- 419d Agitators, top entering
- 419e Mixers, portable
- 419f Mixing & extruding machinery
- 419g Pans, grinding & mulling
- 419h Laboratory & pilot plant equipment
- 419i Stack fans & duct boosters

426 Both items discussed
- 426a Starters, motor; Bul. 6080
- 426b Starters, motor; Bul. 1159

444 All items discussed
- 444a Sprinkler systems automatic
- 444b Hangers, pipe
- 444c Piping systems

465 All items discussed
- 465a Dust filters; Bul. 559
- 465b Dust separators
- 465c Dust separator centrifugal
- 465d Dust filters; Bul 560
- 465e Fans, exhaust

467 Both items discussed
- 467a Furniture laboratory
- 467b Fume hoods

470E Coatings, Plastic; Bul. "Plasticap AB"

470Ex Coatings, protective

CIRCLE code numbers for more information. (This September issue card expires Nov. 1, 1957.)

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36e	71a	105	143	182B	196C	220-1d	329	360a	383	419b	455	470B	477C	483A	492	499C	B510				
36f	71b	106	145	182C	196D	220-1e	330	360b	384	419c	461	470C	477D	483B	492A	499D	524				
36g	72	107	149	183	196E	220-1f	331	361	385	419d	462	470D	477E	483C	492B	499E	25				
36h	73	109	151	184A	197	220-1g	332	362	386	419e	463	470E	477F	483D	497C	499F	526				
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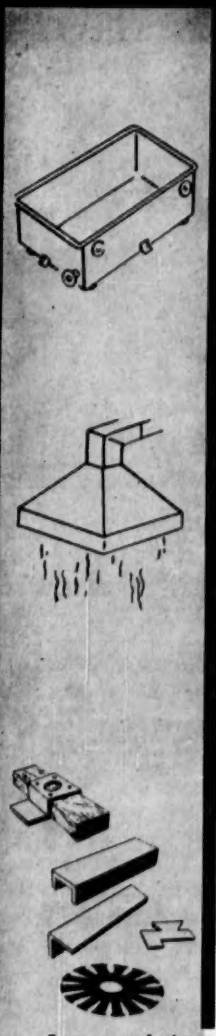
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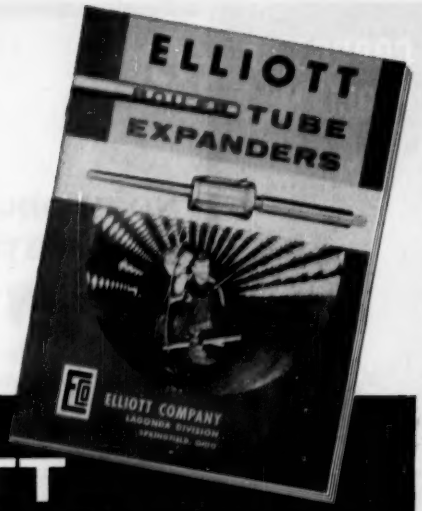
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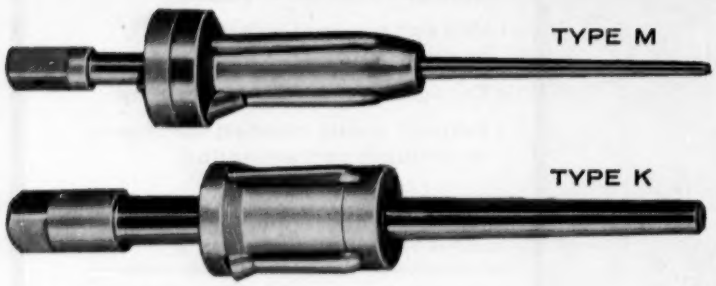
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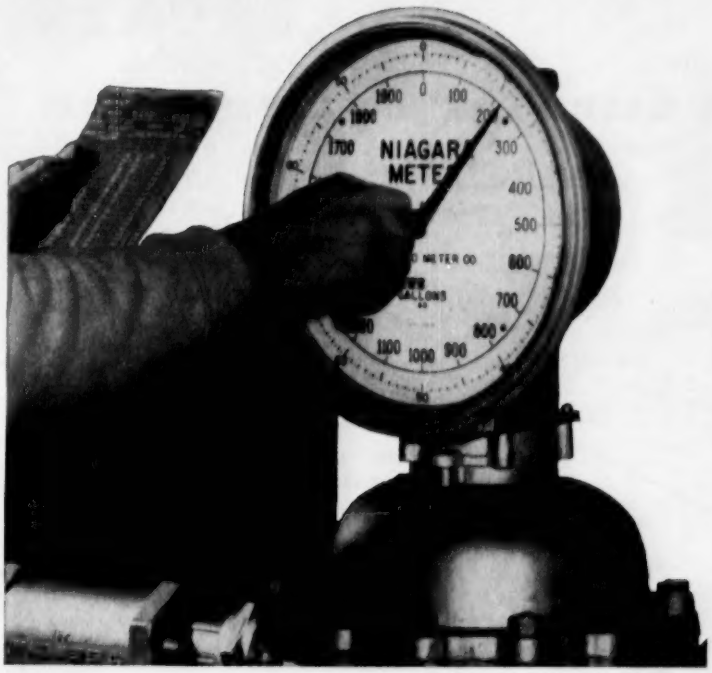
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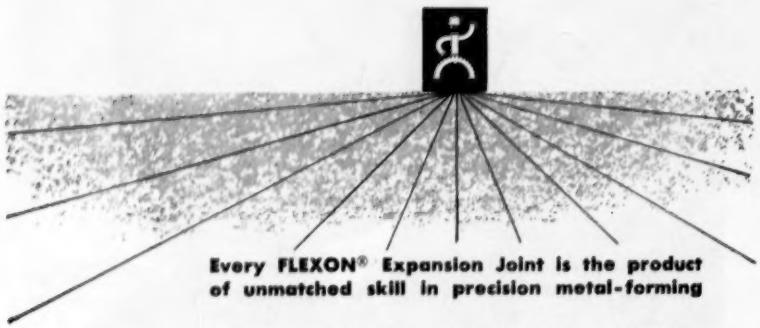
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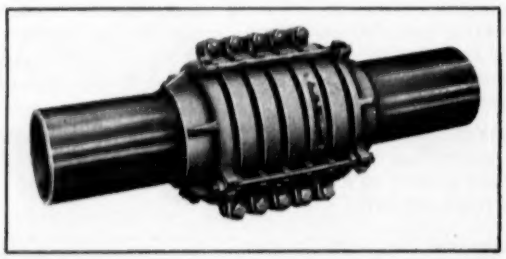
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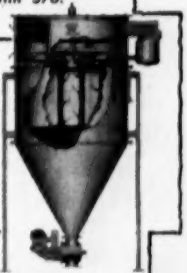
For latest information about DAY "AC" and Dual-Clone equipment write toDAY for Bulletins 559 and 49-DC.

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DAY TYPE "HV" CYCLONIC SEPARATOR

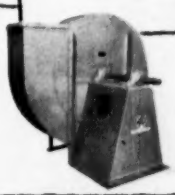
A heavy gauge, welded, high efficiency cyclonic separator. The DAY "HV" has a wide range of applications. It handles abrasive or high temperature dust laden air and requires no maintenance because it has no moving parts. Available for pressure or vacuum operation. For additional information write for Bulletin 576.



DAY TYPE "RJ" DUST FILTER*

A packaged dust filter shipped completely assembled and ready to run. Provides high performance, top efficiency dust control at low cost. High air-to-cloth ratios give extra air handling capacity in small area. Furnished with or without dust fan and discharge equipment. For latest information write toDAY for Bulletin 560.

*Hersey and DAY patents applied for.



DAY TYPE "G" EXHAUST FANS

High air delivery per horsepower required. These fans are designed specifically for dust control applications. Each fan is statically and dynamically balanced before shipment. For further information write toDAY for Bulletin 471.

DAY SINCE 1881

The DAY Company

DAY SINCE 1881

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The DAY SALES Company
856 Third Ave. N.E., Minneapolis 13, Minn.

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P.O. Box 704, Fort William, Ontario.

Representatives in Principal Cities

STOP AIR POLLUTION with DAY DUST CONTROL

Somebody GOOFED



"Somebody" in this man's plant neglected to guard against tramp iron damage to men, materials and machinery. Maybe he thought a spark-induced explosion was a 100 to 1 chance . . . and the whole plant went up in smoke! Maybe he thought a little iron in the material was unimportant . . . and a contaminated product ruined his company's reputation for product purity! Maybe he thought tramp iron wouldn't damage machinery . . . and repairs and down time ate up a big chunk of profit!

Obviously, that "Somebody" goofed. *He didn't remember that Dings offers a complete line of magnetic separators and metal detectors to safeguard personnel, plants and products from tramp iron damage.*

SOMEBODY COULD HAVE PREVENTED TRAMP IRON TROUBLE WITH THESE

DINGS MAGNETIC PROTECTION PRODUCTS

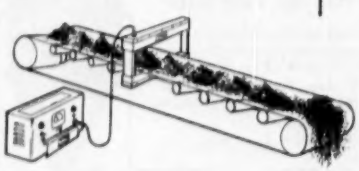


PERMA-PLATE MAGNETS — the most versatile, simplest, and least expensive magnetic separators available for easy installation in chutes, ducts, slides, and over conveyor belts.



SELF-CLEANING RECTANGULAR MAGNETS — equipped with an endless-belt that sweeps iron from the magnet face. Ideal for pulling large quantities of iron from deep burdens on high-speed belts.

METAL DETECTORS — automatically signal the presence of metal in solid, bulk or packaged materials. Available in magnetic or electronic models.



PERMA-DRUMS—assure fully automatic, low-cost iron removal where other type separators may be impractical . . . below apron feeders, chutes, spouts, or in processing machines.



WHICH "SOMEBODY" ARE YOU?

With the Dings complete line to choose from . . . Dings engineering service to help you make the most efficient and economical selection . . . Dings 55 years of experience in solving tramp iron problems like yours — *you* can be the "Somebody" in your plant who increases production and reduces costs! Write us for the solution to your tramp iron problems today.

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Chemicals

Accelerator, Rubber.....Bunac D-74 supplements other primary accelerators; particularly useful in compounding GR-S rubber. Gives many improved properties to rubber. Write for details.
466A Olin Mathieson Chem. Corp.

Acid, Hydrofluoric.....Newly revised 48 p. booklet covers properties and essential information for safe handling and use of anhydrous and aqueous HF. Request data sheet SD-25.
466B Harshaw Chemical Co.

Acid, Oxalic.....Technical information on Oldbury oxalic acid, including specifications, physical properties, packing data, uses, and handling precautions is given in new Data Sheet No. 789.
220-k *Hooker Electrochemical Co.

Adhesive.....Newly developed, AV-24600 can be used for laminating urethane foam to many types of surfaces. Applied by conventional methods; high strength and flexibility. Write for details.
466C Compo Chemical Co.

Adhesives....New adhesives for labels feature resin emulsion glue which penetrates silicone layer to bond on the glass surface. Also controlled tacking in clear microthin films. Write for TD 1260.
36d *U. S. Industrial Chem. Co.

Alcohol, Tetrahydrofurfuryl.....28 p. booklet contains charts & tables, physical data & chemistry, uses, safety & physiological data, and general information. For details, see Bulletin 206.
348 *Quaker Oats Co.

Amines, Fatty.....What they are, what they will do and how they are made are discussed in new 20 p. booklet. Data on vapor pressure, solubility and handling; chemical equations and tables of reactions.
466D Armour & Co.

* From advertisement, this issue.

LITERATURE

EDITED BY N. DEGENHARDT

Boron Compounds.....Three amine boranes — dimethylamine-borane, trimethylamine-borane and pyridine-borane—are now available in research quantities. Bulletin C-200 brings details.
467A Callery Chemical Co.

Butanol.....Booklet presents data on physical and physiological properties, shipping information, solubilities, constant-boiling mixtures and applications. Easy-to-read data charts.
467B Union Carbide Chemicals Co.

Carbon Products....."Carbon Products for the Glass Industry" points out properties of carbon and graphite that make them desirable for many glass handling and component applications. Table lists key features.
467C Speer Carbon Co.

Catalysts.....Catalog lists Girdler's full line of catalysts for hydrogenation, synthesis of gases and hydrogen generation, desulfurization, new catalytic processes. Send for Bulletin GC 1256.
223 *Girdler Co.

Catalysts....."Harshaw Catalysts . . . Made to Your Specifications" includes sections on: typical Harshaw catalysts and how they are used; catalytic chemicals supplied by Harshaw, etc. Available.
106 *Harshaw Chem. Co.

Coolant-Dielectric.....OS-45, silicate ester-based fluid, has been used for low-temperature cooling of electronic equipment in aircraft. Properties and characteristics described in bulletin 0-123.
467D Monsanto Chemical Co.

Elastomers....."Hypalon", a synthetic rubber, has excellent chemical resistance and is useful in valve sleeves, hoses, linings, etc. Neoprene resists chemicals, heat, light. Elastomers Notebook.
295 *E. I. du Pont de Nemours.

Emulsion, Anionic.....Hydrocarbon emulsion features high melting point of emulsion solids and wide pH stability. Used as co-binder for latex paints, clay coatings etc. Bulletin available.
468A Penn. Industrial Chemical Corp.

* From advertisement, this issue.

Contents of This Issue . . .

Chemicals and materials	466
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Greatest Improvement in Fume Hood Air Flow Control in 20 Years!

MINEOLA, N. Y. — Laboratory Furniture Co., Inc., Mineola, L.I., N.Y., announces its revolutionary new Remote Control for Fume Hoods by which air flow for fume exhaust can now be changed during the operation of the fume hood, and with the safety sash open or closed. Described as the "SAFE 'n EASY" Remote Control, this new exclusive device is operated by a handle, located on the outside control panel, which the chemist turns, right or left, to [illegible] bottom

apparatus, crawl inside the hood, reach into the rear to adjust baffles manually, and then replace the apparatus. This procedure can often take as much as an hour, plus the hazards of broken instruments and toxic fumes. Laboratory Furniture's "SAFE 'n EASY" way regulates the air flow with one simple motion outside the fume hood, saving valuable experiment time and [illegible] valuable layers in mat[illegible]



* Patent No. 2779265 January 29, 1957

Famous for many firsts in the industry, Laboratory Furniture's newest improvement for fume hoods, the SAFE 'n EASY way, provides the perfect answer to an old problem. Now, with one simple motion, you can move the baffle by remote control and change the Air Flow inside the operating fume hood . . . without removing the apparatus, and with the sash open or closed. An exclusive STEELAB and WOODLAB feature!



"STEELAB," Revised Edition. Hundreds of ideas for laboratory furniture layouts.

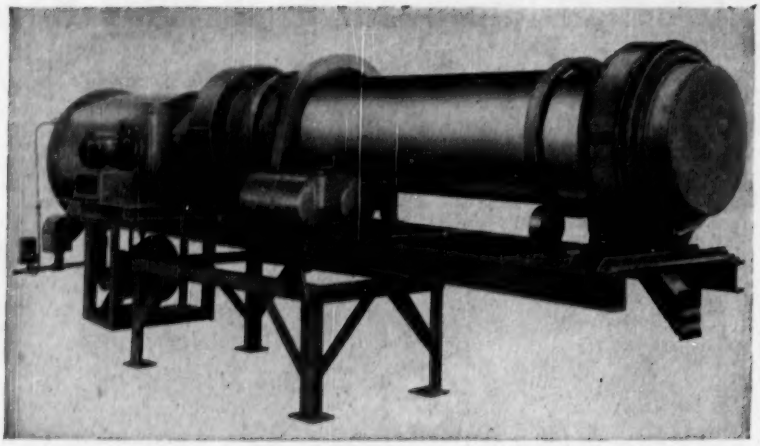
"FUME HOODS" No. 56H. Most complete fume control prospectus in the industry.

WRITE OR CALL TODAY FOR THESE VALUABLE PLANNING AIDS
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Over 35 Years of Specialized Service to Laboratories

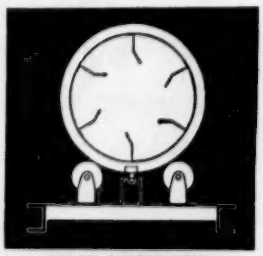
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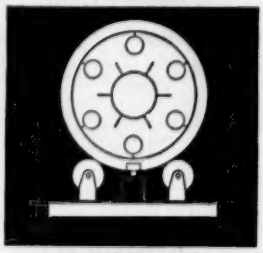
PILOT PLANT ROTARY DRYER

The Ruggles-Coles Pilot Plant Dryer is designed especially for laboratory use or for small capacity unit operations requiring a continuous or intermittent drying step. Each unit:

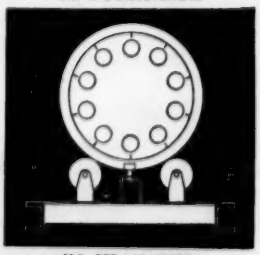
- Is mounted on a structural steel base.
- Has removable "knockers."
- Provides for easy changing of shell rotation speed or shell slope.
- Is available in stainless steel or other corrosion-resistant materials.
- Requires only fuel supply and power connections to be placed in operation.
- Is easily moved from place to place.



XH-XF SINGLE-SHELL



XB DOUBLE-SHELL



XC STEAM TUBE

It is available in three models:

(1) XH-XF single-shell, direct gas fired dryer. Arranged for either parallel or counter-flow operation. Bulletin AH-471.

(2) XB double-shell, indirect-heat, gas-fired dryer for drying without contamination. Volatiles removed with only limited dilution. Bulletin AH-472.

(3) XC steam-tube indirect heat dryer. Can be connected to any available steam supply or furnished with a 3-HP steam generator. Bulletin AH-473.

For complete information write Department 11

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LITERATURE . . .

Hydrazine Derivatives.....Hydrazine dihydrochloride, hydrazo dicarbonamide and monohydrazinium phosphate, all white crystalline solids, are available in laboratory lots. Data bulletins available.
Olin Mathieson Chemical Corp.
468B

Magnesium Oxide.....Company offers specifications, full information and technical service. Request Magnesium Oxide Brochure for details on high purity, versatile material in several grades.
*International Minerals & Chem.
201

Nitroparaffins.....As solvents, the NP's present an unusual combination of properties. Request Technical Data Sheet for specifications, properties, uses, solubility tables, etc. plus product samp'es.
181 *Commercial Solvents Corp.

Phosphorous Oxychloride.....Clear liquid assays 99.5 minimum phosphorus oxychloride, can be used in making organic phosphates, plasticizers, gasoline additives or fire-resistant hydraulic fluids.
220-Ic *Hooker Electrochemical Co.

Phosphorus Trichloride.... ..Liquid phosphorus trichloride has wide repute as a convenient entry to many types of organic synthesis. Volume deliveries made in lead-lined tank cars. Data sheet.
220-Id *Hooker Electrochemical Co.

Pigment, Red.....Now available for use in printing ink, plastics and rubber. Bright, bluish-shade red with improved light resistance compared to other non-bleeding azo reds. Bulletin C-66.
468C Sherwin-Williams Co.

Plasticizer.....Ester type, suggested where properties of low temperature flexibility, good heat and light stability, low heat loss and low volatility are desired. Plasticizer DP-200 described in data sheet.
468D Harwick Standard Chem. Co.

Plasticizer, Latex.....Plasticizer A-12 emulsion is modifier for both curing and non-curing latex systems. Exhibits good softening, aging and water resistance properties. Write for bulletin.
468E Penn. Industrial Chem. Corp.

Plastics Extender.....Color dispersion and intensity in plastics are said to be improved by a new extender, which is also reported to increase lubricity, mold-release and brightness. TD 1267.
36K *U. S. Industrial Chem. Co.

Polyethylene.....Ziegler process polyethylene is featured in colorful new brochure issued by Hercules. Illustrates plant production of Polymer, products made from Hi-fax and its properties.
468F Hercules Powder Co.

Polymers, Block.....Some characteristics of the many Pluronic grades: defoaming, dispersing and suspending, sequestering, wetting and penetrating, lubricating, dedusting, free rinsing, etc. Grid data.
64-5 *Wyandotte Chem. Corp.

Polyvinyl Compounds ..... Company offers booklet on their polyvinyl compounds, rigid "Geon" resins which offer superior resistance to oils, acids, alkalis and most chemicals. Easy to form, readily welded.
9 *B. F. Goodrich Chem. Co.

* From advertisement, this issue.

Rubber Reclaiming Oil.....Bunac K8 reclaiming oil produces reclaim of higher tensile strength and lighter color than any other oil. Now available in drum and tank car lots. Data Sheet.
469A Olin Mathieson Chem. Corp.

Rust Remover.....A double acting rust remover is said to remove light rust in a few minutes, heavy rust in one to two hours. Deposits a rust-inhibiting film as it works, needs no rinsing of metal. TD1263.
36g *U. S. Industrial Chem. Co.

Salicylaldehyde.....Versatile salicylaldehyde, a reactive intermediate, is used in the preparation of coumarin, pharmaceuticals, dyestuffs, and additives. Technical data and samples available.
177 *Heyden Newport Chem. Corp.

Silica Gel Indicators.....Literature available giving comparative data on complete line of indicating silica gel products. Used to show changes in relative humidity by changes in color.
469B Davison Chemical Co.

Sodium Dispersions.....Newly revised and expanded brochure. "Sodium Dispersions", covers preparations and use of microscopic particles of sodium dispersed in organic hydrocarbon media. Illustrated.
36a U. S. Industrial Chem. Co.

Solvents, Aromatic.....Cover a wide evaporation range. Their individual characteristics satisfy specific requirements in a variety of formulations. "Shell Aromatic Solvents for the Coatings Industry."
153 *Shell Oil Co.

Solvents, Petroleum.....Three new Shell solvents in mineral spirits distillation range are being produced for paint and dry cleaning industries. Further information supplied on request.
469C Shell Oil Co.

Solvents & Organo-Metallics.....Deuterated solvents and organo-metallics of high isotopic purity are now available in experimental quantities, with a wide range of research applications. TD 1266.
361 *U. S. Industrial Chem. Co.

Varnish, Ink.....New non-blocking wet ink varnish offered. Intended for can manufacturers and metal decorators, varnish has good color retention and non-blocking properties. Request details.
469D Pittsburgh Plate Glass Co.

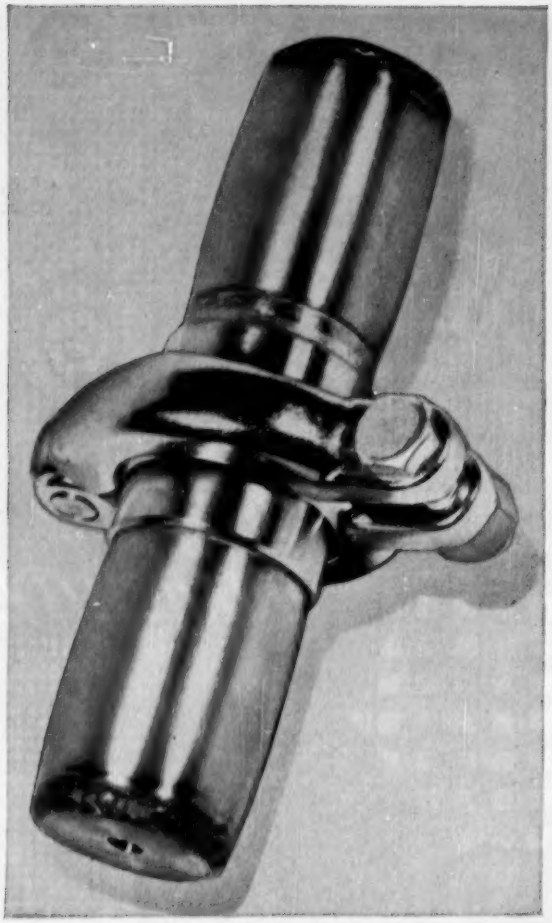
Construction Materials

Alloys, Corrosion-Resistant..... Have excellent resistance to hot mineral acids, strongly oxidizing salts, powerful gaseous oxidants, and combinations of these media. "Hastelloy Corrosion-Resistant Alloys."
309 *Haynes Stellite Co.

Alloys, Corrosion Resistant.....Carpenter Stainless No. 20 and No. 20Cb Handbook contains physical, corrosion resistance and fabrication data on these super-corrosion resistant alloys. Free.
449 *Carpenter Steel Co.

* From advertisement, this issue.





We put 4200 pounds pressure on this Cherry-Burrell C-I-P union

...and what happened? As you can see, the tubing is just about shot—distorted and ready to pull apart.

But the Cherry-Burrell C-I-P fitting passed this extreme test with flying colors. Even at 4200 pounds pressure, the joint was *leakproof beyond the distortion point of the tube itself.*

Cherry-Burrell vise-type construction assures metal-to-metal rigid joints; nontoxic, nonabsorbent, acid-impervious Teflon gaskets—all combine to give the strongest, most product-free joints you can find. *Bacteria swab tests after 2 years of operation* have given practically zero counts.

Now offered at same price as regular gasket seat fittings. See your Cherry-Burrell Representative for full details. Or write for literature.

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Dairy • Food • Farm • Beverage • Brewing • Chemical • Equipment and Supplies
SALES AND SERVICE IN 58 CITIES — U. S. AND CANADA

LITERATURE . . .

Alloy, Heat-Resistant.....Latest high temperature strength data on B & W Croloy 18-8 Ti (AISI Type 321) for long-time service at elevated temperatures is presented in Alloy sales letter 288.
470A Babcock & Wilcox Co.

Alloys, High Temperature.....Users of tubing and piping at elevated pressures and temperatures will find up-to-date information about B & W Croloy 2¼ and Croloy 1¼ in Bulletins 145 and 152.
470B Babcock & Wilcox Co.

Aluminum.....Facts and figures on applications of aluminum construction in chemical industry appear in brochure, "Reynolds Aluminum Tanks and Vessels." Resists strong corrosive action.
60-1c *Reynolds Metals Co.

Castings, High Alloy.....High alloy castings to order, large, small, special shapes, corrosion resistant, heat resistant and abrasion resistant. Melt and finishing controlled and tested. Bul. 3354-G.
476 Duraloy Co.

Coatings, Dispersion..... Advantages of halo flourocarbon dispersion coatings for corrosion control and contamination prevention described in 4 p. booklet. Gives chemical and physical properties.
470C Minnesota Mining & Mfg. Co.

Coatings, Fluidized.....Use of fluidized plastic coatings in corrosion control discussed in special 6 p. report. Discusses mechanism of fluidization, coatings available, cost factors and applications.
470D American Agile Corp.

Coatings, Plastic....."Plasticap AB" describes baked-on non-laminar composite film combining high temperature properties with universal corrosion resistance and mechanical strength for tubular goods.
470E Plastic Applicators Inc.

Coatings, Protective..... Descriptive literature available on new epoxy-resin zinc-dust coating for steel. Affords maximum electro-chemical cathodic protection and is less expensive than sprayed zinc metal.
470F Steelcote Mfg. Co.

Coatings, Protective.....Amercoat 87, a true vinyl mastic, protects special areas such as rivets and angles from weather and chemicals. Lasting corrosion-resistance with less painting. Details.
317 *Amercoat Corp.

Coatings, Protective....."Cold galvanize" existing steel structures with 100% inorganic zinc protective coating. One spray coat protects against weathering exposures to sea air & salt water. Request Dimetcote Bulletin.
470G Amercoat Corp.

Coatings, Spray.....Three types of "Rokide" spray coatings protect a wide variety of parts, from baffle plates to thermocouple tubes. Hard, adherent, crystalline refractory materials. Bulletin.
111 *Norton Co.

Coatings, Vinyl.....Users of vinyl paints can now get five to eight times the film thickness per spray pass through use of Lankote 200-H vinyl coatings. Data sheet available for these fast-dry coatings.
471A J. Landau Co.

* From advertisement, this issue.

Coatings & Linings.....Bulletin VP-2 describes Unichrome Plastisols, which produce thick, corrosion-resistant vinyl coatings. Bulletin Chem-C-2 describes phenolic coatings for tank linings.
116 *Metal & Thermit Corp.

Fabrication, Plate.....Heat exchangers—steel and alloy plate fabrication; containers and pressure vessels for gases, liquids and solids. Company offers details in bulletins on experience and facilities.
14 *Downingtown Iron Works.

Fabrication, Plate.....Plate fabrication and erection of vessels, tanks, towers, odd and intricately designed chemical equipment . . . to any size . . . of any material. Complete details in Catalog 54B.
96 *Hammond Iron Works.

Felts, "Armalon"....."Armalon" is the new felted form of Du Pont's "Teflon" tetrafluoroethylene resin, available in two constructions, one for filtering, the other for gasketing. Descriptive Bulletin.
213 *E. I. du Pont de Nemours & Co.

Felt, Synthetic.....According to Technical Data Sheet 19, Feutron synthetic felts now are more dense than could be manufactured previously using synthetic fibers. Covers characteristics and properties.
471B American Felt Co.

Fencing, Aluminum.....Fenced areas require no preventive maintenance when they have aluminum chain link fencing. Resists corrosion even in the most active industrial atmospheres. Brochure.
60-1d *Reynolds Metals Co.

Insulation.....A set of six specifications discusses use of Foamglas insulation on industrial equipment and piping. Each booklet suggests thicknesses to use, details installation practice and finishes.
471C Pittsburgh Corning Corp.

Insulation..... Thermobestos insulation for outdoor process industry applications has top insulating effectiveness, high strength, light weight and moisture resistance. 12-page Thermobestos booklet.
174-5 *Johns-Manville Co.

Insulation, High Temperature..... Properties and data, including insulating efficiency and resistance to vibration, are listed in brochure WMF-2 for Micro-Quartz and Glass Micro-Fibers insulation.
471D L. O. F. Glass Fibers Co.

Insulations & Coatings.....Company offers literature on a full line of insulations and coatings, including Armaflex, Armaglas, and Armatemp Insulations, and Armstrong Insulcolor Coating.
413 *Armstrong Cork Co.

Linings, Protective.....New "Fairprene" protective lining material is pre-vulcanized, can be applied on location to minimize equipment downtime. Offered in sheet, tape, cements, putty. Booklet.
433 *E. I. du Pont de Nemours & Co.

Paint, Vinyl.....A new vinyl paint is said to achieve 5 to 8 times the film thickness per spray pass as other vinyl paints. Supplied in 8 colors, fast drying, easy to apply, economical. TD 1265.
361 *U. S. Industrial Chem. Co.

* From advertisement, this issue.

DRY AIR . . .
PRECISELY as you want it

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always.

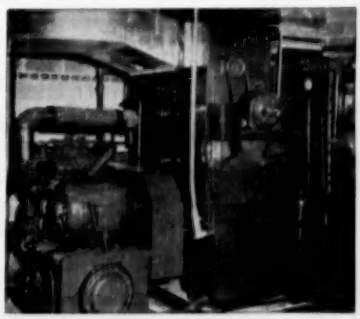
Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.



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Coliseum, New York City, December 2 – 6, 1957
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Aero AFTER COOLERS • Aero REFRIGERANT CONDENSERS • Aero STEAM CONDENSERS
Aero VAPOR CONDENSERS • HUMIDIFIERS
HEATERS • COOLERS • DRYERS
BOOTH No. 655

Write for full information; ask for Bulletins 112 and 121 Address Dept. CE-9

NIAGARA BLOWER COMPANY
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District Engineers in Principal Cities of U. S. and Canada



Using vertical polarized light on a cross-section of pipe, photographer Bernard Hoffman clearly shows the ravages of corrosive action.

Controlling Corrosion in Fluid Engineering

Corrosion seldom works alone. Together with heat, pressure and abrasion factors, it compounds the problems of fluid engineering. But when you have valve design problems involving corrosion, you can look to the engineering leadership available at S. Morgan Smith for assistance.

You can use R-S Rubber-lined Butterfly Valves, for instance, to handle many special applications. The rubber lining protects the entire valve body, gives you corrosion resistance with maximum economy. Where your processing problem demands additional engineering, you can draw on the broad SMS background of experience in specialized valve applications.

There is a complete SMS line – Rotovalves, R-S Butterfly Valves and Ball Valves – to meet your fluid control problems. To obtain full information, contact our nearest representative, or write S. Morgan Smith Company, York, Penna.

S. MORGAN SMITH — HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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LITERATURE . . .

Plastic, Laminated.....Company offers free samples, technical literature on "Lamicor", a light-weight construction material that combines high corrosion and chemical resistance with strength.
461 *Strick Plastics Div.

Putty, Epoxy-Resin.....Bulletin 11 tells how the A2 series of aluminum filled epoxy resin compounds are used for repair and maintenance where chemically stable, non-shrinking, non-flammable putty is needed.
472A Smooth-On Mfg. Co.

Refractory Grain.....“Norton Refractory Grain,” offers many charts, tables and photographs in color—a wealth of information on nature, performance, and application of refractory grains. Ask for a copy.
305 *Norton Co.

Rubber & Steel, Welded.....Resiliency of rubber and strength of steel offer an unbeatable combination against corrosion, abrasion, erosion; welded with adhesion of over 500 psi. Bul. 55.
344 *La Favorite Rubber Mfg. Co.

Stainless Steel Plates & Heads..... Carlson's Weekly Stock Lists tell you exactly what is in their large, diversified stock of stainless steel plates and heads in various types and grades.
222 *G. O. Carlson, Inc.

Steel, Abrasion Resisting.....Revised Bulletin 11-3 deals with specially balanced composition of abrasion resisting steel supplied in sheet and plate form for structures and equipment. Performance records.
472B Joseph T. Ryerson & Son.

Steel, Glassed.....Bulletin discusses the resistance of Pfaudler glassed steel to acids at various high temperatures. Resistivity is comparable to that of laboratory glassware. Bulletin No. 928.
56-7c *Pfaudler Co.

Steel Wire & Rod.....Recently issued section of the Steel Products Manual covers wire and rods, carbon steel. Includes chemical ranges and limits, methods of manufacture, evaluation and tables of gages.
472C American Iron & Steel Inst.

Steels, Rubber-Lined.....Ace rubber-lined steel . . . strength and pressures of steel plus chemical resistance of hard rubber. Excellent for alkalis, most inorganic acids, etc. Full details in Bulletin CE-52.
341c *American Hard Rubber Co.

Steels, Stainless.....Company offers informative 44 p. booklet. “Making the most of Stainless Steels in the Chemical Processing Industries.” Dozens of Crucible stainless grades are available to you.
81 *Crucible Steel Co. of America.

Tiles, Floor.....Duro acid-proof tiles are recommended for durable, chemical-proof floors. Variety of cove base shapes and standard rectangular sizes makes for close-fitting construction. Bul.
127 *Harbison-Walker Refractories.

Titanium.....For process development work, take advantage of titanium's corrosion and cavitation resistance, light weight and high strength. Company offers informative titanium booklet.
50-1 *Du Pont Co.

* From advertisement, this issue.

Titanium ..... Shows resistance to chloride solutions and retains useful strength up to 800-1000F. Other advantages and data on application and fabrication of titanium in Rem-Cru Review.
10 *Rem-Cru Titanium.

Titanium.....24-page "Titanium Fact File" gives key data on physical, mechanical and corrosion properties; metallurgy; machining; forming and welding. Table compares titanium with other pure metals.
473A
Mallory-Sharon Titanium Corp.

Zirconium & Hafnium ..... Brochure describes these metals, their properties, fabrication and uses in the nuclear and chemical processing industries. 12 p. technical brochure "Zirconium & Hafnium." TD 1264.
36h *U. S. Industrial Chem. Co.

Electrical & Mechanical

Amplifier, All Transistor.....Designed for analog computation and amplification for low-level d.c. signals such as produced by strain-gage transducers or thermocouples, amplifier is covered in Bul. 3003.
473B Beckman Instruments.

Batteries, Industrial.....Revised catalog and data sheets give details on Exide's new line of F batteries in plastic jars. Capacity ratings are greater through use of plastic jars, and jars are leakproof.
473C Electric Storage Battery Co.

Box Car Pullers.....Powerful S-A car pullers eliminate the slow and ineffective use of pinch bars, allow tow-trucks and tractors to do the duties they were designed for, company says. Bul. 753.
212a *Stephens-Adamson Mfg. Co.

Casters & Wheels.....Featuring Darnelloprene treads (a soft resilient Neoprene rubber compound) . . . casters offer ease of movement, quietness and protection for floors. Details available in Manual.
R497 *Darnell Corp.

Conduits, Aluminum ..... Company offers literature and one-foot sample of Alcoa Aluminum Electrical Rigid Conduit, which weighs 2/3 less than steel, is safer, easier to bend and thread. No straining.
211 *Aluminum Co. of America.

Drive, Variable-Speed.....“Performance 'Round the Clock" is the theme of Bulletin 522 on the Graham variable-speed drive. Complete explanation with drawings highlights why this transmission is outstanding.
473D Graham Transmissions.

Drives, Pneumatic ..... Pneumatic power drive units that remotely operate and position valves, dampers, louvers, rheostats, vanes and variable-speed drives are described in new Bulletin 1033.
473E Blaw-Knox Co.

Engines.....New 16-page Bulletin 257 details four-cycle diesel, duafuel and spark ignition gas engines. 640 to 2,150 hp. Ratings, outline dwgs. and all dimensions for preliminary planning are on data sheets.
473F Nordberg Mfg. Co.

* From advertisement, this issue.

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PHOSPHA[illegible] CHARATE
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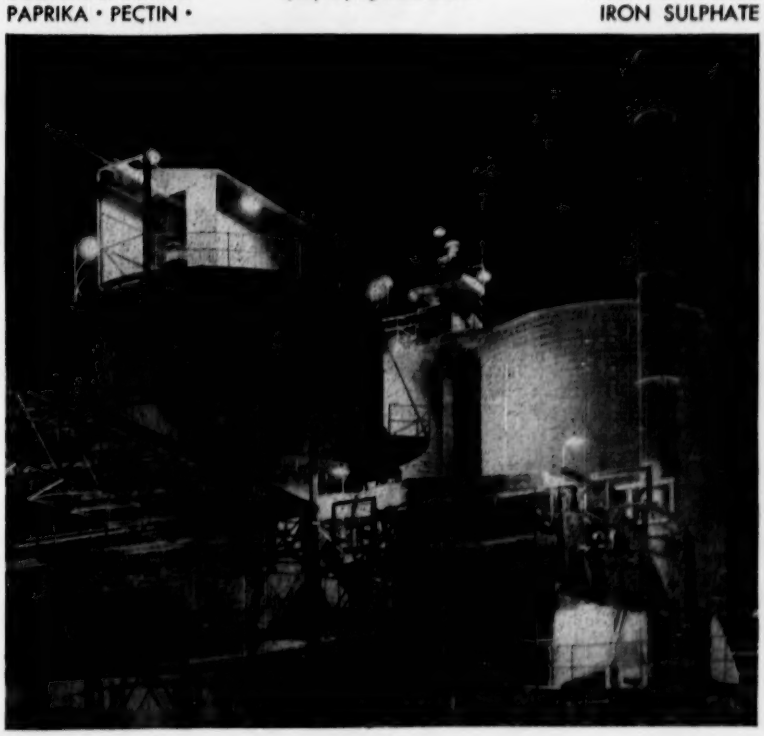
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Below: **Large Nerco-Niro spray drying installation.**





"57" platform lifts easily for cleaning and lubrication. Note simplified lever system and ball bearing platform support, designed to absorb loading shocks and eliminate excessive wear on the pivots. Platform overhangs base to protect against dirt and dust in the lever system.

It's NEW . . . a 1000 lb. capacity portable beam scale, specially designed by Howe for its 100th anniversary! New features, rugged all-metal construction and dependability, new advanced styling—and a special anniversary price—mean more scale value for you with the "57"!

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LITERATURE . . .

Expanders, Boiler Tube.....16-page bulletin describes general types of Elliott boiler tube expanders for fast, efficient tube rolling jobs. Also dimensions, prices, other data. Bulletin Y-46.
462 *Elliott Co.

Floats.....If you have a liquid level control problem that involves a float, send for Harris Float Catalog. Complete technical data on various types and sizes of floats in several suitable metals.
TR510 *Arthur Harris & Co.

Gaskets & Rings, Teflon.....Bulletin describes Chemlon gaskets and "O" rings, made from practically indestructible "Teflon". Gives styles, pictures, specifications. Request Bulletin P-327.
474A *Crane Packing Co.

Generators, Inert Gas.....Assure a safe, dependable supply of chemically clean inerts. Deliver inerts at a special analysis . . . without fluctuations. For facts and technical data, request Bulletin No. 1-10.
327 *C. M. Kemp Mfg. Co.

Hangers, Pipe.....Company's trapeze functional spring hangers, with patented internal swivel action, support piping. Experienced engineers design hangers for your requirements. Catalog 54.
444b *Blaw-Knox Co.

Motor Drives, Variable Speed.....New Reeves Vari-Speed Motordrives, sizes 200 and 300 are complete variable speed power packages for installations 1 through 5 horsepower. Models in Cat. CE 32-M571.
367 *Reeves Pulley Co.

Motors.....Diehl offers Consolidated Motor Catalog and Price List No. CE-9-3540. Long experience in designing and manufacturing motors for industry to meet special requirements, problems.
403 *Diehl Mfg. Co.

Motors, Electric..... Wagner Increment Motor-Starter Combinations provide low cost control, meet the polyphase motor starting recommendations of the AEIC-EEI-NEMA. Bul. MU-128 and MU-195.
414 *Wagner Electric Corp.

Motors, Explosion Proof.....All-new line of totally enclosed explosion proof motors with rugged frame design for improved performance in hazardous locations described in Bulletin 1200.
439 *Fairbanks, Morse & Co.

Motors, Standard..... Sterling Advanced Design, normal-speed electric motors are described in new 12-page brochure 194. Several applications are illustrated and much valuable selection material is included.
474B Sterling Electric Motors.

Motor Starters & Contactors..... Complete line of motor starters and contactors shown in 12-page Bulletin 14B8615 assure full rated capacity, maximum protection, longer life and easy maintenance.
474C Allis-Chalmers Mfg. Co.

Motors, Vertical Pump.....Louis Allis vertical pump motors used with vertical turbine pumps will conserve floor space and provide a more compact streamlined installation. See Bulletin 1250.
474D Louis Allis Co.

* From advertisement, this issue

Packings, Saddle ..... Packs without "nesting," surface area is exposed area, more uniform free space, better liquid distribution, better drainage, less weight. Full data in Bulletin S-29.
136 *U. S. Stoneware.

Power Centers ..... Company's dry-type power centers can be put closer to load, are lighter, packaged, simple to maintain, and fire-safe. Savings can pay for initial investment. New D. D. 34-150.
20-1 *Westinghouse Electric Corp.

Reducers, Motor.....Motors can be interchanged or replaced in minutes with the all-steel Falk motoreducer. Replacement is not limited to original make of motor. More information in Bulletin No. 3100.
*Falk Corp.

Reducers, Speed.....Cleveland Worm Gear Speed Reducers are designed for tough jobs which demand dependable performance under difficult conditions. Free Bulletin 145 gives data on all models.
12 *Cleveland Worm & Gear.

Relay, Protecting.....Leaflet tells how Type TNS bus-bar protecting relay protects a transformer and its connected load of 3-phase induction motors against voltage unbalance, single phasing, motor overload.
475A Electrical Service Co.

Seals, Fuel Resistant.....Leaflet tells about use of new LS-53 fluoro-silicone rubber in construction of seals that have high resistance to fuels, together with extreme flexibility at low temperature.
475B Connecticut Hard Rubber Co.

Seals, Mechanical ..... Company's "Mechanipak" package seals can be installed on chemical process pumps to eliminate leakage and shaft wear, reduce downtime, cut maintenance costs. Folder AD-150.
30-1 *Garlock Packing Co.

Seals, Mechanical ..... Combining chemically impervious teflon with a balanced bellows design—Chemiseal mechanical seals last longer and give unsurpassed performance. Full details in Bulletin MS-1155.
363 *U. S. Gasket Co.

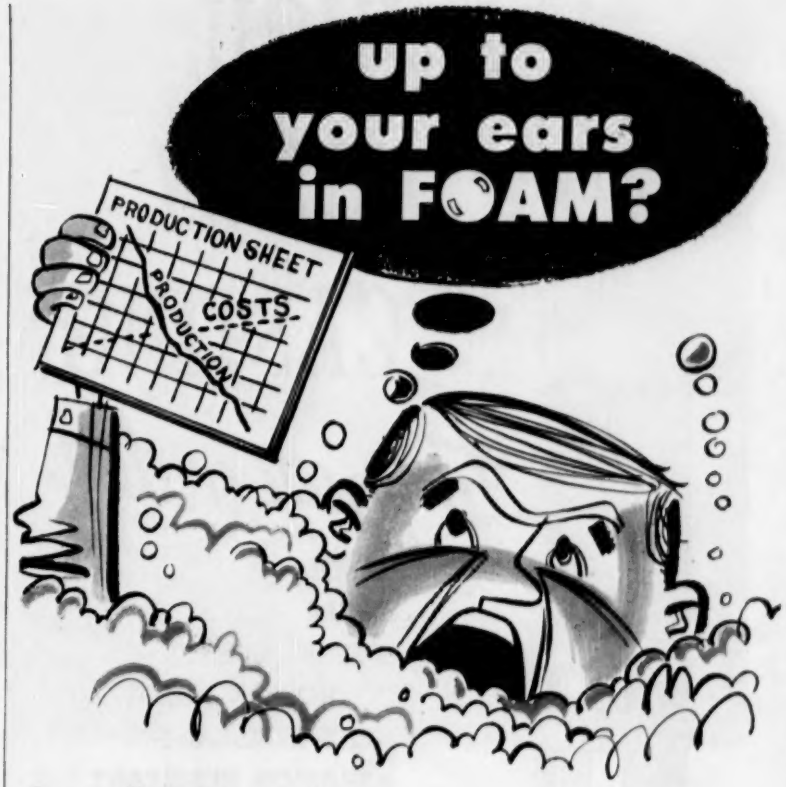
Seals, Mechanical.....For pumps, agitators, autoclaves and similar processing equipment. Complete story of line of Chempro "wedge-lock" mechanical seals in Bulletin CP551 and 575.
L497 *Chemical & Power Products.

Seals, Mechanical.....Valuable reference for maintenance engineers and original equipment designers. Illustrates and describes types of Dura seals engineered to meet your specifications. Catalog No. 480.
B506 *Durametallic Corp.

Seals, Mechanical, Rotary ..... Company announces the availability of an 8 p. reference which shows how you get maintenance-free sealing that slashes fluid mixing cost to a new low. Bulletin B-111.
155g *Mixing Equipment Co.

Seals, Shaft.....Bulletin gives overall information on line of shaft seals for every liquid handling service, from hot or cold water to the most destructive corrosives. Bul. S-204-3.
369 *Crane Packing Co.

* From advertisement, this issue.



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Effective against even the most violent foamers, Dow Corning SILICONE DEFOAMERS are so efficient they pay for themselves many times over. And remember when you use one of these economical silicone defoamers, you also free yourself from the worry of boil-overs and any fire hazards that may result.

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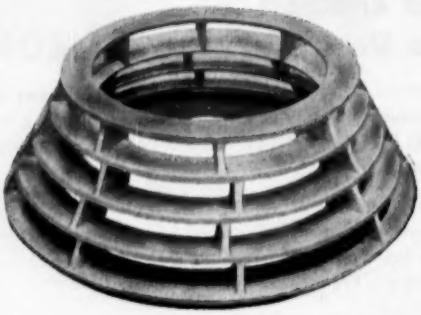
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DETROIT OFFICE: 23906 Woodward Avenue, Pleasant Ridge, Mich.

LITERATURE . . .

Seals & Stuffing Boxes.....Corrosion resistant seals and stuffing boxes for "E", "P" and "R" series vessels are discussed in Bulletin No. 938. Interchangeability of seal and stuffing box is stressed.
476A Pfaudler Co.

Starters.....New ZHA high voltage starters are only 30 inches deep. Save valueable floor space, provide more accessibility and convenience than before. Self-contained, safe. Bulletin 8130-F.
320 *Electric Controller & Mfg.

Starters, Motor.....Complete line of high tension starters for large synchronous and squirrel cage motors has the new Allen-Bradley air break, high voltage contactor as basic unit. Bulletin 6080.
426a *Allen-Bradley Co.

Starters, Motor.....Bulletin describes company's nonreversing automatic across-the-line starter for high voltage squirrel cage motors on pumps, air and refrigeration compressors, etc. Bulletin 1159.
426b *Allen-Bradley Co.

Transformers, Variable.....Illustrated bulletin describes Powerstat variable transformers for high frequency applications with specifications, outline dimensions and ratings. Bulletin P257H.
476B Superior Electric Co.

Transmitters, Cell Flow.....Company's d/p Cell Flow Transmitters have revolutionized many an industrial process, by modern high speed flow measurement and control. Details in Bulletin 13-11A.
48-9 *Foxboro Co.

Turbines, Gas.....Versatile Westinghouse gas turbine, with many combinations of output in shaft power, compressed air and hot gas can be used to streamline processes. Process sketches.
88 *Westinghouse Electric Corp.

Turbines, Solid-Wheel.....Feature reliable, trouble-free operation. Rugged construction and superior design result in savings by keeping maintenance costs down to a minimum. Details in Bulletin No. S-116.
218 *Terry Steam Turbine Co.

Unions, Forged Steel.....W-S forged steel unions machined in accordance with ASTM material specifications A-105, Grade 2. Available with screw-end & socket-welding end pieces. Bul. U-1.
331 *H. K. Porter Co.

Welding Outlets.....Bulletin Cp-1-57 describes Couplet line of strong, easy-to-install branch connections for tanks, pressure vessels and pipelines. They function as universal outlet connections.
476C H. K. Porter Co.

Winches.....You can lift heavy loads quickly and easily with S-A hand and motor winches, designed for dependable, trouble-free lifting power. Types & sizes in stock to meet your job needs. Cat. 853.
212b *Stephens-Adamson Mfg. Co.

Handling & Packaging

* From advertisement, this issue.

Conveying Systems.....Conveying of dry bulk materials can be accomplished automatically by air, with Fuller systems. Designed for minimum maintenance, completely enclosed. Bulletin G-2.
398 *Fuller Co.

Conveyor, Gravity ..... Application ideas and features of Rapistan Flow Track gravity conveyor are presented in new Bulletin FT-57. Complete specifications are included in literature.
477A Rapids-Standard Co.

Conveyor, Roller ..... New Bulletin RR-57 discloses details on a new aluminum 1.75 in. roller conveyor. Non-corrosive, non-sparking nature of conveyor is good in high humidity and explosive conditions.
477B Rapids-Standard Co.

Conveyors, Screw ..... Link-Belt's sound engineering and quality manufacture assure you of top performance. A 92-page Screw Conveyor Book contains complete ordering data. Data Book No. 2289.
17 *Link-Belt Co.

Conveyors, Spiral.....Jeffrey spiral conveyor systems, automatically controlled, offer economical means of handling dry, loose bulk materials. Compact, convenient, open or dust-tight. Cat. 851.
92 *Jeffrey Mfg. Co.

Crane, Traveling Overhead.....Series of pages with marginal tabs and split horizontally at the center enables anyone to select the exact overhead crane to meet particular job requirements.
477C Manning, Maxwell & Moore.

Cylinder, Compressed Gas.....Complete information on a new 132 cu. in. disposable cylinder for handling freon and other aerosols and compressed gases is presented in new product Bulletin DC-257.
477D Tube Manifold Corp.

Feeder, Chemical.....Feeder Model E featured in new Bulletin 575 is an 18-8 stainless steel unit for controlled feeding of liquids with precision, dependability and low cost. Handles wide range of rates.
477E Clarkson Co.

Feeder, Volumetric.....Recent 8-page Bulletin 2—P2 informs you about the Omega universal feeder that feeds any dry material over a 40 to 1 adjustable feed rate from 1 to 5,000 lb./hr. Request a copy.
477F Omega Machine Co.

Feeders, Wet Reagent.....Accurately meter minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Request copy of Bulletin F6-B9.
381e *Denver Equipment Co.

Fuel Oil Treatment.....Disintegration and dispersal of sludge in fuel-oil storage tanks and equipment is discussed in new Bulletin FO-157. Sludge becomes combustible and water is emulsified.
477G North American Mogul Prod.

Hoppers, Self-Dumping ..... Hoppers introduced recently for handling of wet or dry, cold or hot bulk materials by industrial trucks are illustrated and described in a new catalog sheet. Request a copy.
477H Apex Weld. & Fabricat. Corp.

* From advertisement, this issue.



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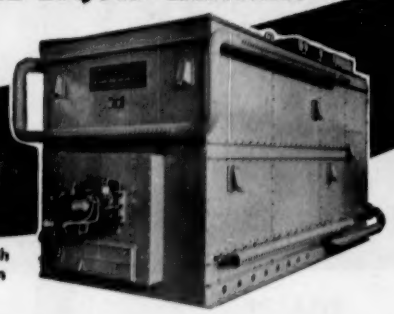
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LITERATURE . . .

Outsert Applicators . . . . . Automatic machine attaches sales aids such as recipes & coupons to the outside of your containers. Outsert applicator works on glass, metal, plastic or paper. Bul. 933.
56-7d *Pfaudler Co.

Packaging, Pressure. . . . . Complete information about the one-use pressurized can will be found in the 3rd edition of the Pressure Packaging Catalog. Lists suppliers of valves and loading equipment.
478A Crown Cork & Seal Co.

Sifter. . . . . New illustrated specification sheet B-106-RA describes operation of the Ro-Ball Airmatic, a combination dump bin, sifter and airmatic conveyor for handling dry materials similar to wheat flour.
478B Cleveland Automatic Mach. Co.

Tables, Concentration . . . . . Separate materials into bands & handle coarsest sands with excellent results. Ideal for separation of groups of particles having similar range of specific gravities. Request Bulletin TI-B3.
381h *Denver Equipment Co.

Tanks, Chemical Storage . . . . . Company supplies tanks and vessels for chemical storage, made of carbon and stainless steel, aluminum and special alloys. 103 years of experience. Get "Tank Talks."
BR501 *R. D. Cole Mfg. Co.

Tanks, Floating Roof . . . . . Various types of floating roof tanks for storing all types of volatile or corrosive products are detailed in a new 24-page illustrated catalog 57 FR. Different types are highlighted.
478C Hammond Iron Works.

Tractor-Loaders . . . . . TL-6 Tracto-Loader is easily maneuvered in a confined space, with its compact design and short turning radius. Company offers a free descriptive catalog of complete line.
135 *Tractomotive Corp.

Trucks, .Electric. . . . . Lewis-Shepard Electric Trucks enable full use of floor storage, provide mobility between departments, work quickly and safely, cut manpower costs. Master Line Cat. and Cat. 34-1.
71b *Lewis-Shepard Products.

Trucks, Electric Fork. . . . New "E" model electric fork truck—electric power gives 3 times longer life than other type trucks, lubricated-for-life, only 50¢ a day for battery charging, magnetic controls. Cat. 32-1.
71a *Lewis-Shepard Products.

Trucks, Fork. . . . . Engineering specifications, dimensions and mechanical features of 5,000-lb. capacity gas-powered line of fork trucks are contained in a new 6-page brochure now being offered on request.
478D Clark Equipment Co.

Trucks, Industrial. . . . . Complete Clark line of fork-lift trucks, straddle carriers, powered hand trucks and towing tractors is described in 16-page catalog just out. Illustration and specifications for each.
478E Clark Equipment Co.

Vibrator, Bin. . . . . Information about the new UCV series of Vibrolators is presented in a new brochure. Units are used for moving, sifting, settling, conveying or packing granular material of every type.
478F Martin Engineering Co.

* From advertisement, this issue.

Weigher, Conveyor Belt.....How the modified Conveyoflo meter continuously feeds and totalizes belt-conveyed dry material is described in new Bulletin 550-P5. Dimensional data and line drawings.
479A Builders-Providence.

Heating & Cooling

Air Conditioning, Controlled Humidity.....Method removes moisture from air by contact with a liquid in a small spray chamber. Heating or cooling done as separate function. Details in Bulletins 112 and 121.
471 *Niagara Blower Co.

Cooling Coils.....“Prestfin—A Proven and Distinctly Better Finned Cooling Coil” is the subject of Bulletin No. 158-A. Among Prestfin’s advantages is claimed to be a perfect bond between fin and pipe.
479B Frick Co.

Cooling Units.....Company’s horizontal core units are vertical air discharge coolers for oil, water, chemicals and compressed gas, and also condensers for petroleum vapors, steam. Catalog 550.
492 *Young Radiator Co.

Furnace.....1957 edition of Petrochem Isoflow furnace manual has been broadened to include data from over 1,650 additional installations. Nine different types of Isoflow furnaces are described and illustrated.
479C Petro-Chem Development Co.

Generators, Steam.....Amesteam generators give extra years of service. Rugged construction exceeds code requirements; simple, efficient 3-pass concentric tube design. Request your catalog.
119 *Ames Iron Works, Inc.

Generators, Steam..... Book gives capacities, dimensions, construction features, instrumentation, accessories, sectional drawings & installation photos on new series of steam generators. Bulletin PG-55-3.
163 *Foster Wheeler Corp.

Heat Exchangers.....Book gives cost comparisons between the use of Wolverine Trufin and prime surface condenser tubing in heat transfer applications. “Comparative Heat Exchanger Costs”.
103-4a *Wolverine Tube Div.

Heat Exchangers, Aluminum.....16-page brochure, “Reynolds Aluminum for Heat Exchangers”, explains advantages of aluminum, such as low cost, less tendency to foul than other metals, light weight.
60-1b *Reynolds Metals Co.

Heat Transfer Fluid..... Company offers a list of designers and manufacturers of heating systems using their Aroclor 1248 non-pressurized liquid-phase heat transfer fluid. New, fire-resistant, stable.
91 *Monsanto Chemical Co.

Heat Transfer, Pilot Plant Unit..... Girdler’s line of Votator heat transfer units for laboratory or pilot plant work. High rate of heat transfer, pressures to 500 psi. Free Bulletin V217.
2 *Girdler Co.

* From advertisement, this issue.



Tolhurst centrifugal cuts 48 processing hours down to 8



In a leading chemical plant, one Tolhurst Batch-Master centrifugal is now processing the same volume of fine organics in 8 hours as two other centrifugals formerly did in 24 hours. The reason: Tolhurst’s hydraulic unloader and bottom discharge unload the solids in just 30 seconds. The other batch centrifugals with manual unloading took 15 minutes or more. And Tolhurst labor savings on the job amounted to 16 manhours a day.

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Send your free 4-page Bulletin TC-14-56 giving full data on Batch-Master Centrifugal.

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Multi-Metal's achievements over the years in improving on existing filter leaf designs and in creating entirely new ones – such as the Multi-Leaf and the Rim-Lok shown here–have resulted in notable upgrading of functional efficiency of leaf type filters. Possibly your filtration step can be improved by tapping this integrated source of design, weaving and fabrication.

"Multi-Matter," our information-packed house organ, includes a series of articles dealing with various aspects of "The Importance of Properly Designed Filter Leaves." The current issue explores these specific points–Functions, Media and Types of Closures. Write for a copy today.



"RIM-LOK" rectangular leaf for vertical tank pressure filters – absolutely leakproof construction – facilitates cake discharge – withstands hard usage. Provides maximum filtering area.



Arc-side "RIM-LOK" leaf for horizontal tank filter offers maximum effective filtering area without sacrificing rigidity.



Leaf for Kelly filter featuring "Baffle" chamber; bare (for bag or caulked covers), or dressed with metallic cloth.



Disc sector for rotary leaf pressure filter.



"Multi-Leaf" for Sweetland pressure leaf filter with "BWD" (bottom waste discharge) outlet which permits easy flushing of the leaf interior to remove accumulated solids.

Write for our new Catalog #57.

MULTI-METAL WIRE CLOTH CO., INC.
1353 GARRISON AVENUE, NEW YORK 59, N. Y.

LITERATURE . . .

Heaters.....Grid Products Catalog 956 holds complete story on Grid unit heaters, blast heaters and Grid radiation for chemical plant use. Grid cast iron steam heat transfer surface described.
432 *D. J. Murray Mfg. Co.

Heaters, Air.....Versatile design permits Thermal Type CA heater to be used in a variety of installations with either gas, oil or combination firing. Complete details in Bulletin 104.
488 *Thermal Research & Engrg.

Heaters, Circulation.....8 p. bulletin describes Chromalox automatic electric circulation heaters, for controlled heating of water, oils, heat transfer media, steam, air and other gases. Bulletin 701.
114 *Edwin L. Wiegand Co.

Heaters, Thermal Liquid.....Company's thermal liquid heaters offer advantages: accurate temperature control; high heat transfer rates; low cost, low pressure operation; heat on demand. Bulletin TLH.
478 *International Boiler Works.

Thermo-Panels.....Cost less and perform better—an improvement on pipe coils. Save space and heat or cool more efficiently. For use in heating and cooling of liquids, slurries, etc. Bulletins 355 and 257.
TL509 *Dean Thermo-Panel Div.

Traps, Steam.....Sarco Thermostatic steam traps are compact and light, freeze-proof and have only one working part, which can be inspected or replaced in a few minutes. Request free copy of Bulletin 250.
299 *Sarco Co.

Traps, Steam.....Yarway 20-A Impuls pulse Steam Trap has light load applications in refineries, chemical and processing plants, power plants, hospitals, schools and institutions, etc. Bulletin T-1739-X.
421 *Yarnall-Waring Co.

Traps, Steam.....Armstrong Steam Trap Book contains helpful information on steam trap safety factors providing for venting of gas, peak loads, reduction in pressure differential, group trapping.
435 *Armstrong Machine Works.

Trap, Steam, Thermostatic.....Bulletin 257 tells about a new line of industrial thermostatic steam traps designed for weather conditions encountered in outdoor processing areas as well as inside.
International Basic Economy Corp.
480A

Instruments & Controls

Analyzer, Infrared.....In the new MSA Lira booklet, you'll find out why the Model 200 low-cost infrared analyzer provides fast, easy process measurement and control. Safety is greater, costs lower.
480B Mine Safety Appliances Co.

Analyzers, Moisture.....Nuclear Magnetic Resonance (NMR) analyzer measures the total moisture content of the material being tested, with extreme speed and accuracy. Technical data available.
126 *Schlumberger Well Surveying.

* From advertisement, this issue.

Annunciator Systems.....New 32 p. catalog describes the complete line of standard, integrated Panalarm Annunciator Systems for industry. Company makes full details available in Catalog 100B.
L350 *Panellit, Inc.

Comparators.....Fully illustrated, 100 p. handbook tells how to use pH and chlorine control for water supplies, process solutions, production processes in 34 basic industries. Covers complete line of comparators.
L491 *W. A. Taylor & Co.

Control Systems, pH.....Continuous pH control systems protect process cooling towers. Careful analysis for each individual tower is provided. Request Data Sheet 700(1) and questionnaire.
412 *Leeds & Northrup Co.

Controls, Packaged.....How valves can be controlled at lower cost is told in Bulletin 982 "Series 300 Packaged Control System." System is ideal for any application that needs positioning, indication and remote control.
481A A. W. Cash Co.

Controls, Pneumatic.....More than 10 pages of general automatic control theory are included in the 44-page Bulletin, A130, on Series 500 pneumatic recording and indicating controllers. Request a copy.
481B Bristol Co.

Controls, Temperature.....Explosion-proof automatic temperature control, Type D98, has a multiple-turn, micrometer type adjustment. Company offers full engineering data in Bulletin 3-1.
360a *United Electric Controls.

Controls, Temperature.....Type E98 automatic temperature control is sensitive, automatic, with external, calibrated temperature adjustments made by single-turn knob and pointer. Bulletin 3-5.
360b *United Electric Controls.

Controls, Temperature.....17 p. catalog presents company's line of remote bulb temperature controls for industrial, aircraft, marine, special purpose. Includes features, specifications, etc. Catalog Sec. 200.
481C United Elec. Controls Co.

Detector Kits, Vapor.....A small, compact and practical detector kit rapidly determines low concentration of vapors of toluene diisocyanate and toluene diisocyanate urea. TD 1270.
36n *U. S. Industrial Chem. Co.

Flowmeters.....Company has prepared technical briefs on all four basic types of flowmeters, describing operating principles and advantages of each. Also selection and cost comparator charts.
157 *Fischer & Porter Co.

Gages, Heated.....Complete line of heated gages has models to meet your specific problems in handling heavy or viscous liquids. Heated by steam or electricity. Jerguson Heated Gage Catalog.
L501 *Jerguson Gage & Valve Co.

Gages, High Pressure.....Strahman high pressure gages are used in refineries and chemical plants throughout the world. Company makes information available in catalog. Request your copy.
R491 *Strahman Valves.

* From advertisement, this issue.



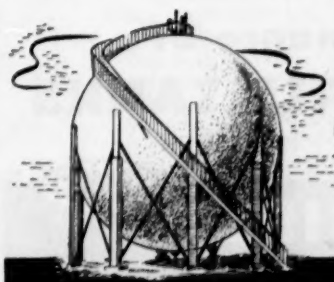
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LITERATURE . . .

Gages, Pressure.....Complete Helicoid line of pressure gages is graphically described and illustrated in 32-page catalog G-52. Utmost precision and enduring accuracy is reported under severe conditions.
482A American Chain & Cable Co.

Gage, Tank.....Details of construction and operation of new No. 30 tank gage are found in Bulletin 571. Installed on either old or new tanks, gage is highly accurate, completely automatic and easy to read.
482B Johnston & Jennings Co.

Gage, Ultrasonic.....Bulletin V-301 discusses advantages of ultrasonic corrosion inspection. Instrument is considered ideal for determining corrosion rates in thousandths of an inch per year.
482C Eranson Instruments.

Gage, Ultrasonic.....How the Vidigage detects flaws or internal discontinuities in regluarly shaped metals and plastics is described in Bulletin V-302. It provides a check on bonds between laminations.
482D Branson Instruments.

Instrumentation.....New literature package # 4-1 covers important areas of instrument applications in spectrophotometry and gas chromatography. Includes fluorescence and near infrared spectrophotommetry.
482E Beckman Instruments.

Instruments.....Catalog 51-1450 shows new small-case line of instruments for indicating, transmitting and controlling pressure and temperature. Housed in fiber glass cases, instruments resist outdoors.
482F Fischer & Porter Co.

Instruments.....Seventeen new instruments for digital and analog instrumentation are described in a new short form catalog C704. Included are preset EPUT meters and portable EPUT meters.
482G Beckman Instruments.

Instruments.....Using an arrow and caption method, Bulletin MSP-141 explains features of newly designed line of Ring Balance recorders, indicators and controllers. Includes full-page table of applications.
482H Hagan Chemicals & Controls.

Instruments & Controls.....In Publication 57-687-297 you will find a digest of specifications of instruments and controls manufactured by the Hays Corp. Covers pressure, flow, level, temp. and analysis.
482I Hays Corp.

Leak Detector.....Bulletin GEC-336B explains operating principles of Type M-2 mass spectrometer leak detector and describes 5 methods of leak detection. Includes specs., maintenance information.
482J General Electric Co.

Meter, Air Velocity.....Illustrated brochure describes instrument that reads both suction and supply air velocities. Details made available on request in a new company bulletin 2448-G.
L505 *Illinois Testing Labs.

Meter, Count Rate.....Suggested uses and applications of Model 727 logarithmic count rate meter are discussed in a new 2-page illustrated Bulletin 3002-7. Includes data on range, accuracy, dimensions, etc.
482K Victoreen Instrument Co.

* From advertisement, this issue.

Meters.....Data file 111 describes many ways EPUT and frequency meters can be used. It covers measurement of frequencies, rotational velocity, flow, pressure, temperature and strain. Charts and graphs.
483A Beckman Instruments.

Pushbuttons.....Company asserts that there is a Square D Pushbutton unit to fill any requirement. Three complete lines, for standard duty, heavy duty and oil-tight heavy duty. Bulletins available.
85 *Square D Co.

Recorders.....Offer valuable features: pre-calibrated plug-in receiver units; up to 4 pneumatic or electronic receivers—or 2 receivers and 2 integrators; etc. Request Product Specification E12-5.
98 *Bailey Meter Co.

Recorder, Water Vapor.....A continuous water vapor recorder determines low concentrations of water vapor in air or gas streams by measuring heat energy exchanged in adsorption or desorption. TD 1268.
361 *U. S. Industrial Chem. Co.

Refractometers, Differential.....Brochure discusses theory and principles of refractometry as well as describing the Barnes differential refractometer with features and specifications of 3 models.
483B Barnes Engrg. Co.

Thermometer, Tank.....Bulletin S-54 lists the features of a corrosion-resistant tank thermometer. One-piece plastic cup case is non-sparking plastic; tube is held by sturdy clips, replaces easily.
483C Weksler Thermometer Corp.

Timer, Cycle.....Complete technical information on a new motor driven cycle timer. Type 571, is available in Bulletin PB-571. Includes application and operation data and nonstandard arrangements.
483D Cramer Controls Corp.

Timer, Interval.....In Bulletin PB-271 you'll find catalog and technical data on a new manually set, motor driven interval timer, Type 271. Covers construction, application and operation details.
483E Cramer Controls Corp.

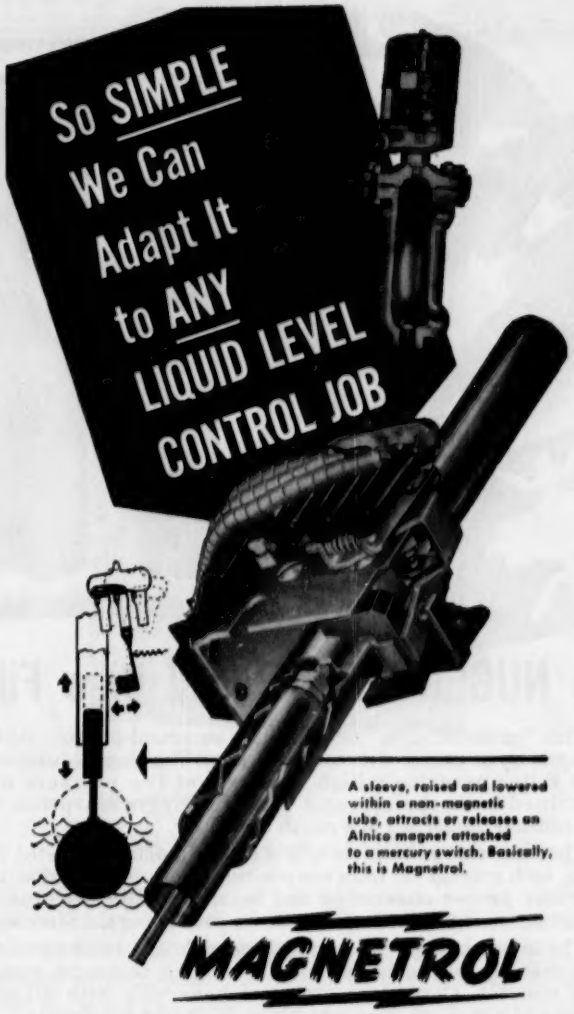
Timers, Electronic.....New 4-page bulletin on line of electronic timers provides specifications, applications and operation of 11 timers of the repeat cycle, interval and delay types. Available on request.
483F G. C. Wilson & Co.

Pipe, Fittings, Valves

Fittings, Stainless Steel.....Speedline fittings simplify pipeline design. Details of the greater design flexibility possible with Speedline fittings . . . at lower cost . . . available in illustrated brochure.
438 *Horace T. Potts Co.

Fittings & Flanges.....Vogt drop forged steel fittings and flanges have unmatched strength and toughness for the most severe pipeline duties. Laboratory controlled materials. Catalog F-9.
234 *Henry Vogt Machine Co.

* From advertisement, this issue.



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● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

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the NUGENT Laminated Disc Filter

This "extended area" filter utilizes an actual filtering surface area greatly in excess of its container area. The Nugent Laminated Disc Filter provides a high flow rate at low pressure drop combined with the extreme fine filtering absorption and neutralizing properties of a depth type filter.

The filter charge consists of a stack of similar crenulated fiber discs, each rotated 45° from the position of the adjacent disc, thus affording proper channeling and maximum filtering capacity. Liquid passes from the exterior to the interior of the filter stack.

The filter recharge has a useful life of from 4 to 10 times that of a cellulose or waste recharge. Changing recharges requires only minutes. Cartridges are interchangeable with all other Nugent bag or depth type cartridges. Write for full details.

DESIGN FEATURES

- Provides "Extended Area" filtering
- Removes solids as small as 2 microns
- Removes acid forming contaminants
- Will not remove additives
- Contains no chemicals or bleaches
- Working pressure 125 psi—tested to 375 psi
- High pressure filters to 600 psi—tested to 3000 psi
- Built in by-pass relief
- Maximum operating temperature 375°F.

HOW IT WORKS



Each disc in filter stack is rotated 45° from position of adjacent disc for proper channeling and maximum filtering capacity.

Established 1897

Wm. W. Nugent & Co., Inc.

3458 Cleveland Street Skokie, Illinois

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LITERATURE . . .

Hose, Metal, Flexible.....Produced in various alloys of stainless steel—in monel, bronze, and carbon steel. Ideal for use with high temperature and high pressure corrosive gases. Bulletin 21-A.
195 *Atlantic Metal Hose Co.

Hose, Teflon.....R/M flexible, thin-wall "Teflon" hose is recommended for extremes of corrosion and temperature in critical fluid services. Wide range of diameters and wall thicknesses. Bul. 6700.
122 *Raybestos-Manhattan Inc.

Joints, Expansion.....Free-flexing and controlled-flexing; dual and multiple types; balanced joints and other special designs; all in stainless steel, monel, and other workable alloys. See 28 p. Design Guide.
464 *Flexonics Corp.

Joints, Expansion Rubber.....U. S. Rubber Expansion Joints are resilient, do not become brittle, absorb axial and lateral deflection, insulate against vibration and pump noise. Request catalog.
167 *U. S. Rubber Co.

Joints, Pipe Ball.....How to handle thermal expansion and contraction in piping with Barco ball joints is outlined in a new 6-page Bulletin 31. Illustrations cover four basic motion principles.
484A Barco Mfg. Co.

Joints, Swing.....OPW ball bearing swing joints provide full, unrestricted flow, effortless movement, greater load carrying capacity for safety handling liquids. Catalog F-8 provides full data.
18b *Jordan Corp.

Joints & Couplings.....for maximum safety specify R/M "Teflon" Expansion Joints and Flexible Couplings in your critical fluid lines. Details contained in company's free booklet on R/M "Teflon" Accessories.
364 *Raybestos-Manhattan.

Multitube. Polyethylene.....Offers economy with lasting dependability in your instrument tubing problems. Can be pulled through conduit or raceways. Furnished in 7 contrasting colors. Bulletin H-356.
T 500 *Crescent Insulated Wire.

Nozzles, Agitating.....Bulletin discusses capacities and characteristics of Pfaudler Agitating Nozzles along with new data on turbulent flow in reactor jackets. Request Bulletin 950.
56-7b *Pfaudler Co.

Nozzles, Spray.....Company provides a 48 p. industrial catalog with full data on thousands of standard and special nozzles—for every type of spraying. Also information on related equipment. Catalog No. 24.
T508 *Spraying Systems Co.

Nozzles, Spray.....Interesting new group of full cone spray nozzles provide extremely small capacities and atomization using hydraulic pressure only, according to Data Sheet 4517 now available.
484B Spraying Systems Co.

Pipe.....Request your free copy of this new pipe fabrication team bulletin, called "How Piping is Fabricated." Tells how Flori fabricates its pipe and how they sell this pipe as a team.
75 *Flori Pipe Co.

* From advertisement, this issue.

Pipe, Hard Rubber.....Heat-resistant nitrile hard rubber pipe handles inorganics at 250-275 deg. F . . . also resists wide range of organic chemicals at room temperature. For details see Bulletin 96-A.
340G *American Hard Rubber Co.

Pipe, Plastic.....General-purpose moderately priced rubber-plastic pipe handles most common chemicals to 170 F, except few strong acids & organic solvents. Tough, odorless, tasteless. Bul. 80.
340a *American Hard Rubber Co.

Pipe, Plastic.....Polyvinyl Chloride is the unparalleled material for plastic pipe. It's a high quality unplasticized rigid pipe designed to do a better job than any other material. Details in Bulletin 24.
110 *U. S. Steel Corp.

Pipe, Plastic.....Catalog 401 covers development, application, installation and specifications of Orangeburg S.® Plastic pipe made from a recently developed superior type of polyethylene. Request a copy.
485A Orangeburg Mfg. Co.

Pipe, Rigid.....Koroseal rigid pipe is exceptionally easy to install. Can be threaded with standard pipe threading equipment, quickly joined to Koroseal valves and fittings. Details available in booklet.
19a *B. F. Goodrich Industrial

Pipe, Saran Lined.....Saran lined pipe, fittings and valves cut corrosion costs . . . can be cut in the field with available pipe fitter's tools. Liquid never touches metal in saran lined pipe. Request details.
215 .. .. ..*Saran Lined Pipe Co.

Pipe & Sheets, Polyvinyl Chloride..... Koroseal polyvinyl chloride material comes in pipe, pipe fittings, rods, sheets; it is inert, easily cleaned, needs no painting. Free booklet on pipe & sheets.
19 *B. F. Goodrich Ind. Prod. Co.

Pipe & Tubing.....New, illustrated 58 p. handbook packed with data on stainless and high alloy tubing, including analysis and conversion tables, corrosion characteristics, weights, etc.
113 *Trent Tube Co.

Piping Systems.....Blaw-Knox designs and erects pre-fabricated piping systems to meet individual requirements. Modern shop facilities, new method of stress calculation. Bul. 2443.
444c *Blaw-Knox Co.

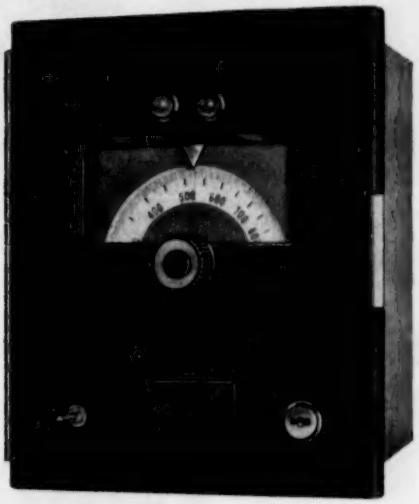
Process Pipe, Aluminum.....Booklets, "Corrosion Keys for Aluminum" and "Aluminum Process Pipe" explain advantages of aluminum pipe: low cost, resistance to corrosion, non-sparking, long life.
60-1a *Reynolds Metals Co.

Tubing, Heat Exchanger & Condenser .....B & W heat exchanger and condenser tubing checks corrosion, prevents product contamination. Made in a wide variety of grades and thicknesses. Bulletin 329.
230 *Babcock & Wilcox Co.

Tubing, Titanium.....Pamphlet on titanium tubing offers information on size range and tolerances and on mechanical, physical and working properties of tubular titanium. Request information on TD 1261.
36e *U. S. Industrial Chem. Co.

* From advertisement, this issue.

New, *Transistorized* Temperature Controller



Provides

Much Greater Sensitivity

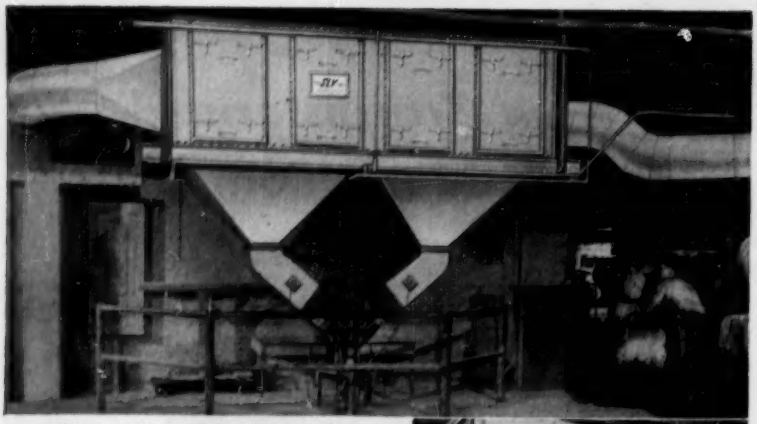
Long Life, Lower Maintenance

Use of **transistors,** rather than electronic tubes, in this ON-OFF signalling controller provides a tremendous increase in both the life and dependability of the instrument. Ruggedly constructed, it can withstand severe conditions of vibration and shock without loss of sensitivity or accuracy. Maintenance, naturally, is sharply reduced.

Available for either thermocouples or resistance bulbs, this transistorized controller also provides greatly increased sensitivity – acting on a temperature change of but ½°F. Use of regular A.C. line voltage eliminates the need of a standard cell and battery. **Periodic standardizing** to maintain factory accuracy of the null balance measuring circuit **is no longer necessary.** Calibration accuracy is guaranteed to within ¼ of 1% of scale span. Scale ranges are available for all standard calibrations – covering temperatures from minus 320°F. to plus 3000°F.

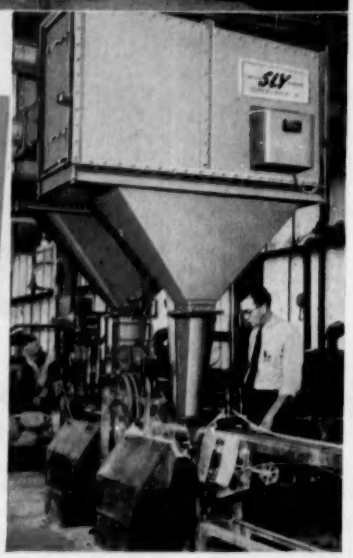
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Sly Dust Filter collects soapstone from green-tire-dusting operation.

COMPACT SLY DUST FILTERS Save Installation Expense at B. F. Goodrich



Sly Filters collect soapstone and zinc stearate dust during processing of uncured garden hose. Dust is automatically returned to dusting chamber.

In B. F. Goodrich's huge, multi-story Akron plant, dust is created at a number of widely separated processing operations. Individual dust control systems had to be engineered to service them. Piping and installation costs would have been prohibitive if dust filters had to be installed outside. Yet inside ceiling height is only 12 feet.

B. F. Goodrich engineers chose Sly Dust Filters because they provided the necessary compactness and the required capacity. Considerable installation expense was saved. The Sly Filters fit easily into the limited ceiling height and are, therefore, located close to the dust sources. Because they are nearby, complete dust collection is obtained more economically . . . collected materials can be used again . . . the filters are easily accessible for servicing.

At B. F. Goodrich, sound dust control engineering and advanced Sly Dust Filter design have paid off in substantial savings. Learn how you can benefit . . .

WRITE FOR BULLETIN 98 — "Dust Control by Sly"

Designers and Manufacturers of: Dust Control Systems, Industrial Ovens, Blast Cleaning Equipment, Tumbling Mills.

THE W. W. SLY MANUFACTURING CO.

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LITERATURE . . .

Valves.....There's an Ace Hard rubber, rubber-lined, or plastic-lined valve for every corrosion application. Diaphragm, gate and check types. Lists chemicals handled in Bulletin CE-52. Request your copy.
341b *American Hard Rubber Co.

Valves.....Company offers booklet entitled "Valve Performance Facts" on its line of valves and fittings, with 32 case histories throughout industry. Line includes valves for handling chlorine.
197 *Crane Co.

Valves.....Coppus "Sentry" valves stop flow instantly or start flow instantly and automatically; when they flow, it's full flow. Company offers information on several models free of charge.
107 *Coppus Engineering Corp.

Valves.....Company's claim that Crane valves are hard to beat in any service is upheld in their comprehensive 36-page booklet entitled "Valve Performance Facts". Request your copy now.
231 *Crane Co.

Valves.....Complete, new 244-page catalog covers broad range of types, sizes and constructions of Darling gate and check valves and fire hydrants. Includes engineering data, application tips, accessories.
486A Darling Valve & Mfg. Co.

Valves, Bronze & Steel.....Hancock valves: steel gate valves, steel valves, bronze valves, bronze and steel flocontrol valves. Company makes details available in Catalog 200. Request your copy.
486B Manning, Maxwell & Moore.

Valves, Check.....Illustrated brochure deals with check valve uses and advantages in aircraft, missiles and rockets, in general service, corrosive service and low pressure service; also relief & shutoff valves.
486C James, Pond & Clark.

Valves, Check.....Fast, quiet operation means low cost operation for check valves . . . and that's exactly what the Chapman Tilting Disc Check Valve is designed to do. Data in Catalog No. 30-A.
418 *Chapman Valve Mfg. Co.

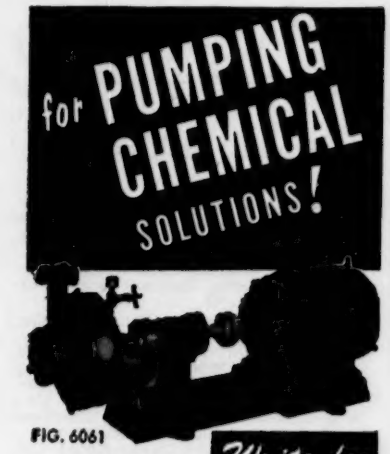
Valves, Corrosion Resistant.....Bulletin describes corrosion resisting stainless alloy "Y" valves, types J and K. Drawings, dimensions, disc arrangement. Request your copy of Bulletin V/7a now.
486D Duriron Co.

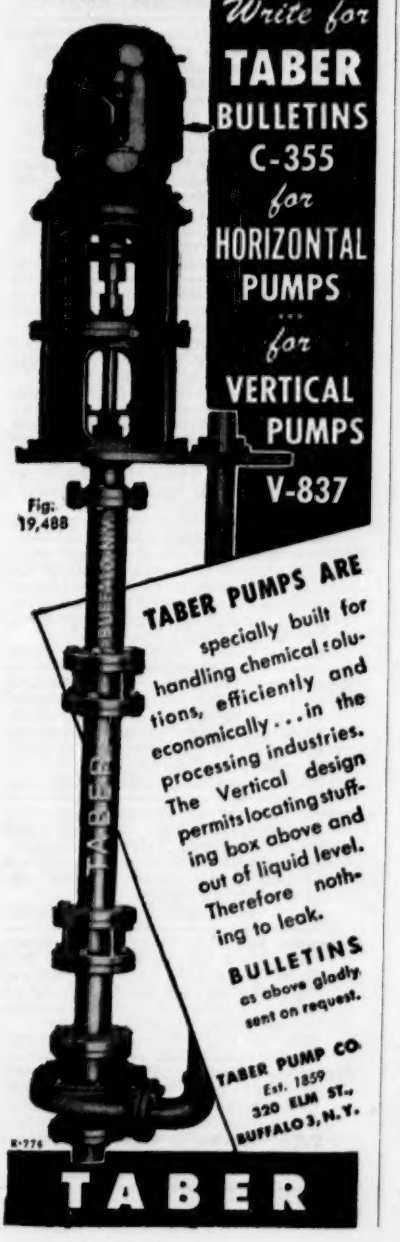
Valves, Diaphragm.....Versatile Hills-McCanna diaphragm valves can handle corrosive or hazardous substances as well as air, water, normal liquid, gas and slurry flows. Request Catalog 104.
486E Hills-McCanna Co.

Valve, Engine Stop.....Combined throttle and automatic engine stop valve described in new 8-page bulletin shuts down turbine, compressor or engine in the event of overspeed or runaway. Request your copy.
Golden-Anderson Valve Specialty.
486F

Valves, Forged Steel.....Chrome stainless steel trim, with case-hardened wedges and discs, assures protection against corrosion, erosion, galling. Specifications, details in Forms 195 & 195-R.
423 *Ohio Injector Co.

* From advertisement, this issue.





LITERATURE . . .

Valves, Gates.....Darling's fully revolving double disc parallel seat principle assures uniform wear distribution, automatic seating compensation, avoidance of disc-to-seat galling. New Catalog 57.
374 *Darling Valve & Mfg. Co.

Valves, Gate....."Ni-Resist" gate valves show their ability to withstand corrosion and cut costs in a wide range of corrosive and erosive services. Combination cast iron & stainless steel. Folder 205.
293 *Jenkins Bros.

Valves, Gate.....Selecting the right O-B bronze gate valve is easy with a new folder, 1323-Vr, which gives basic characteristics to consider and tells when these valves should be used. Valves are charted.
487A Ohio Brass Co.

Valves, High Vacuum.....You'll find descriptions and illustrations of a comprehensive line of high vacuum valves in a new 32-page engineering manual. Covers requirements imposed by high-vacuum service.
487B NRC Equipment Corp.

Valve, Instrument.....According to Bulletin 571 a new line of high temperature instrument valves resists wear better because it incorporates an integral seat insert of chrome-cobalt-tungsten alloy.
487C Rockwell Mfg. Co.

Valves, Packless.....Fulton Sylphon packless valves are complete valves capable of mastering the toughest possible combination of conditions. Assure utmost safety. Request Bulletin 813-PC.
415 *Robertshaw-Fulton Controls.

Valves, Plug.....Homestead Lubricated Plug valves have streamlined ports, controlled pressurized lubricant system, no overlubrication, triple head seal. Request a copy of Valve Reference Book 39-5.
219 *Homestead Valve Mfg. Co.

Valves, Reducing.....Leslie "Hi-Flo" reducing valve with capacity-regulation features never offered before. Have these advantages: fully balanced, drop-tight shutoff, trouble-free design. Bulletin 553.
430 *Leslie Co.

Valve, Shutoff.....Safety shutoff valves described and illustrated in Bulletin 22 include standard solenoid operated valve approved by FM, UL and CSA; four combinations of pressure holding devices.
487D North American Mfg. Co.

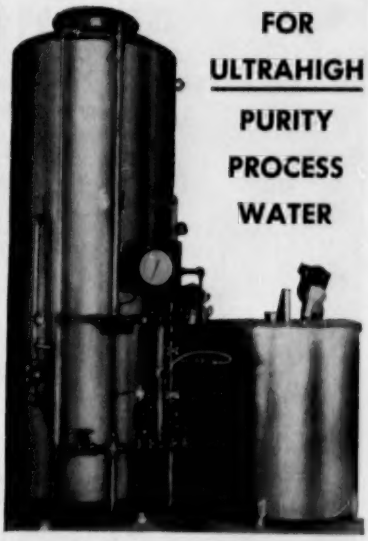
Valves, Sliding Gate.....Unique sliding gate seating design and other exclusive features of the OPW-Jordan pressure reducing valve are responsible for its outstanding performance. Bulletin J-160.
18a *Jordan Corp.

Valves, Stainless Steel.....Cooper Alloy stainless steel valves feature: extra-deep stuffing box, union bonnet joint, retained renewable disc. See "Design Factors in Stainless Steel Valves."
434 *Cooper Alloy Corp.

Valves, Swing Check.....ACE "Darling" swing check valves are lined with hard rubber for the best in corrosion resistance, company claims. Sensitive, non-slamming. Bulletin CE-52.
340d *American Hard Rubber Co.

* From advertisement, this issue.

Manual Monobed Water Deionizer



CHEMICAL ENGINEERS know what contamination can do to an end-product or a chemical process. Contamination by the presence of inorganic impurities in raw, untreated water, for example, is a problem. If you have just such a problem, here's the answer:

This Deionizer can deliver up to 60 gpm of finished water *with less than 0.10 ppm of total dissolved solids present.* One of 5 installed in a major U. S. pharmaceutical house, where they are used to wash ampules, they have proved superior to distilled water. A large-dial, direct-reading quality Controller automatically prevents substandard water from leaving the system. The unit is also available in pilot operated or automatic models, capacities to your "specs."

ADVANTAGES OF DEIONIZATION OVER DISTILLATION

- . . . **Lower Original Cost**
- . . . **Lower Operating Cost**
- . . . **Lower Maintenance**
- . . . **Higher Quality Water**
- . . . **Simpler Operation**
- . . . **Repumping Not Essential**

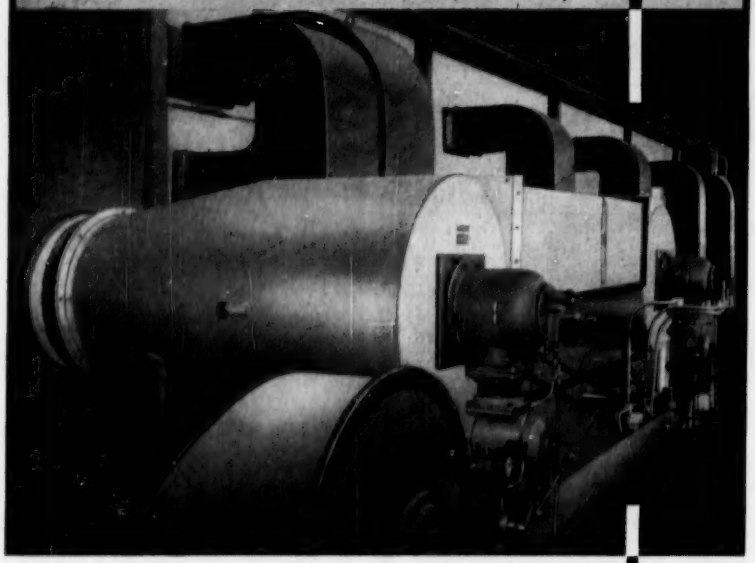
GOT A WATER TREATMENT PROBLEM?
A request on your letterhead brings free Fact File Folder.

H. M. MUELLER CORP.
3338 Gorham Ave. Minneapolis 26, Minn.

"NATURAL WATER IS A RAW MATERIAL; IT SHOULD BE REFINED BEFORE USE."

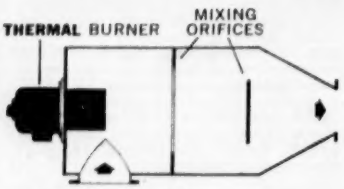
THERMAL'S PACKAGED AIR HEATERS

RATED OUTPUTS TO 20,000,000 BTU/hr



COMPACT...OIL OR GAS FIRED

Extremely versatile design permits the THERMAL Type CA heater to be used in a wide variety of installations and with either gas, oil or combination firing. Shown here is a tunnel dryer installation of the Edgar Plastic Kaolin Co., Edgar, Florida. THERMAL CA air heaters with #7028 burners provide 4,000,000 BTU/hr each using #2 fuel oil. These air heaters are equally adaptable to kilns, ovens, spray dryers and many other installations where products of combustion may be mixed with the air.



NO REFRACTORY REQUIRED

The CA air heater is built around the THERMAL high velocity burner. Because of its unique design, combustion takes place almost entirely within the burner. It normally requires no refractory and provides maximum utilization of available space.

THERMAL'S all-metal, welded construction keeps maintenance costs at a *minimum*. CA air heaters are supplied as complete "package" installations with outputs ranging from 200,000 BTU/hr to over 20,000,000 BTU/hr at all pressure levels.

WRITE FOR BULLETIN #104

OTHER THERMAL PRODUCTS & SERVICES

Gas, Oil & Combination Gas-Oil Burners • Heat Exchangers • Submerged Combustion • Combustion & Heat Transfer Engineering

THERMAL

Thermal Research & Engineering Corp.

CONSHOHOCKEN • PENNSYLVANIA

REPRESENTATIVES IN PRINCIPAL CITIES

Process Equipment

Agitators & Mixers.....Patented stand-pipe around propeller shaft assures positive agitation and circulation, wearing plate presand-up on shut-down. Request a copy of Bulletin A2-B4.
381a *Denver Equipment Co.

Blenders, Liquid-Solids.....Unique one-step method intimately blends liquids into dry solids; perfect dispersion, absolute uniformity. Request Catalog 14 for more information on production models.
356a *Patterson-Kelley Co.

Blenders, Liquid-Solids.....P-K laboratory models quickly demonstrate effectiveness of new concept in liquid-solids blending. Available now in 8 to 16 quart capacities. Request Catalog 15-A.
356b *Patterson-Kelley Co.

Centrifugals.....AT&M centrifugals are used in separation, dehydration, coating, filtering, impregnation and sedimentation processes. Maximum use of time and space, with safety. "Centrifugal Force."
83 *American Tool & Machine.

Centrifugals.....Batch-Master offers choice of perforate and imperforate baskets . . . corrosion-resistant materials . . . manual unloader if desired. Further information available in Bulletin TC-14-56.
479 *Tolhurst Centrifugals.

Centrifuges.....Titan Superjector centrifuge periodically ejects sludge automatically while running at full speed, cleans itself completely in ten seconds or less. Request Bulletin 946.
526 *Pfaudler Co.

Chillers, Water.....Features and components of Airtemp's recently introduced series of centrifugal water chillers are discussed in new folder, Form No. AC-285. Sizes range from 150 to 500 tons.
488A Chrysler Corp.

Compacting Process.....Compacting mill densifies fines into flakes. Flakes granulated in roller mill. Final separation made in gyratory screen. 70 to 80% recovery of salable product. Bul. 25C6177J.
225 *Allis-Chalmers Mfg. Co.

Crushers.....Free literature on ring crushers, shredders and hammer mills features special purpose crushers used for unusual materials as well as many other models. Request Bulletin 257.
T502 *American Pulverizer Co.

Crushers, Jaw.....Eight models, range from 2 x 6 in. jaw opening to 12 x 26 in. Capacities to 30 tph. All except two smaller sizes operate on double cam principle-crush twice per energy unit Bulletin 062.
410b *Sturtevant Mill Co.

Crushers, Jaw.....Forced-feed jaw crushers have cast steel frame, manganese jaw and cheek plates, large diameter shafts, heavy-duty roller bearing in bumper. Full details in Bulletin C12-B12.
381d *Denver Equipment Co.

* From advertisement, this issue.

Crushers, Rotary Fine.....Five models available. Reduce 3 to 8 in. material to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest 10 x 30 in. Bulletin 063.
410a *Sturtevant Mill Co.

Dehumidifiers.....Engineering information contained in new Bulletin R-11B helps the potential user select the correct standard Desomatic Driline pressure dehumidifier to remove moisture from air or gases.
489A Desomatic Products.

Deionizers, Water.....Company's water deionizer removes inorganic impurities in water, can deliver up to 60 gpm of finished water with less than 0.10 ppm dissolved solids. Fact File Folder.
R487 *H. M. Mueller Corp.

Dissolver-Mill.....How the Morehouse-Cowles dissolver-mill combination offers an improved method for preparing asphalt-water suspensions is detailed in application Bulletin 20-1957, available on request.
489B Morehouse-Cowles.

Dry Blenders & Ribbon Mixers..... Ribbon mixers are so designed that any proportion of various materials can be thoroughly mixed. Conical dry blenders are the standard of lower blending costs. Bul. 78.
419b *International Engineering.

Dryers.....Davenport makes pressing, drying and cooling equipment, continuous dewatering presses, rotary dryers (steam tube, hot air, and direct fire), atmospheric drum dryers, etc. Catalog "A".
B503 *Davenport Machine Corp.

Dryers.....Available in several types: direct heat, indirect heat, and steam tube. Let Deco engineers help solve your drying problem—no dryer problem too small or too large. Request Bulletin No. D4-B2.
381j *Denver Equipment Co.

Dryers.....Lectrodryers can dry air and gasses in volume to dewpoints below —100°F—can drop relative humidity lower than 10%. "Because Moisture Isn't Pink" describes drying installations industries.
402 *Pittsburgh Lectrodryer Co.

Dryer-Blenders.....Solid one-piece construction of inner vessel for maximum strength, no joints or clamps to break up the drying surface area. Complete details made available to you in Data Sheet 26.
56-7a *Pfaudler Co.

Dust Collectors.....Ducon centrifugal wash collector, Type UW-4, is a basic air scrubber with many applications for the wet principle collection of extremely fine dusts. Descriptive Bul. W-7456.
349 *Ducon Co.

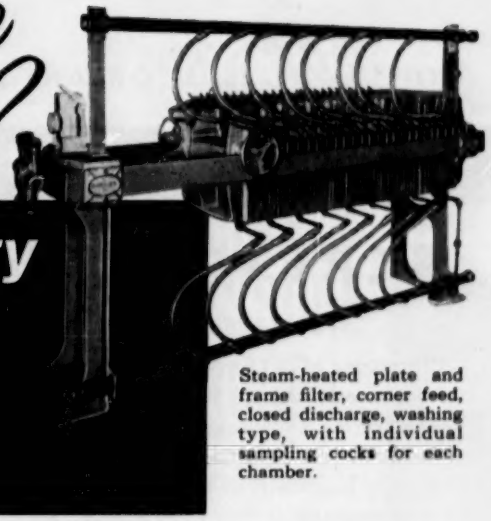
Dust Collectors.....Pangborn collectors trap dust at the source, clean so thoroughly that in the winter many firms cut heating costs by recirculating the already-heated, cleaned air. Bulletin 922.
450 *Pangborn Corp.

Dust Collectors & Fans.....Company offers complete engineering data on their line of completely integrated shop-assembled dust collectors and their industrial exhaust fans. Research facilities.
133 *Fly Ash Arrestor Corp.

* From advertisement, this issue.

Can't be Done?

Let's try it in a Filter Press



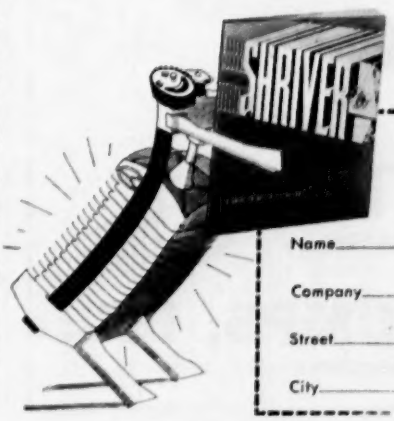
Steam-heated plate and frame filter, corner feed, closed discharge, washing type, with individual sampling cocks for each chamber.

Tried it in your laboratory filter and it didn't work out? Couldn't get satisfactory flow rate or proper cake build-up? Process too slow? The material too viscous or gelatinous or what-have-you?

We've heard all these before. Yet we have proved a thousand times that what the user first considered a tough filtration assignment turned out a routine problem, readily solved in our laboratory. Of course, many problems were challenging, but Shriver experience and designs overcame them, too.

Shriver's long record in solving problems of filtration, washing, extraction or thickening, with the kind of filter press best suited to specific operating conditions, is your assurance of dependable service from laboratory to plant size equipment.

It will pay you to get the Shriver story. Use the coupon.



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for better filtration

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Company_____
Street_____
City_____ State_____

THE *Pitch* IS IMPORTANT IN A

WARREN

SCREW PUMP



The capacity of this pump is determined by the *"pitch" of the screws* and the full load speed of the motor. Expert engineering knowledge of just the right pitch, number of threads, experience data, and precision workmanship are all mighty important in this highly specialized type of pump. It is available in two general types:

Gear-in-head, with internal gears and bearings, for handling lubricating liquids free of corrosive elements and solids.

Double External Bearing and Gear, with separately lubricated gears and bearings, for handling all other liquids.

Standard pumps include jacketed, unjacketed, horizontal, vertical pedestal, vertical bulkhead, long body and hopper types in all machinable metals. Capacities, up to 3000 g.p.m. and pressures up to 700 p.s.i. on low viscosity liquids, and practically unlimited for high viscosity liquids which will flow into the pump inlet.

For specialized services involving hard-to-handle materials, insist upon the original Screw Pump . . . manufactured, serviced and guaranteed by Warren . . . one of the pioneers of the Pump Industry.



Centrifugal • Reciprocating • Rotary

SEND FOR BULLETIN S205

WARREN

WARREN PUMPS, INC.

WARREN, MASSACHUSETTS

G-3

LITERATURE . . .

Dust Control.....Analyses of how dust control equipment solves the problem of recovering valuable dusts—or controlling harmful dusts. Catalog covering technical information. Request No. 800.
424 *Dracco Corp.

Dust Filters.....28 p. book explains in detail the distinguishing features of reverse jet filters. Contains schematic operating diagrams, performance curves for various types of dust. Request Bulletin 559.
465a *Day Co.

Dust Filters....."Type RJ" dust filter is an economical, high efficiency, automatic-continuous dust filter which can be furnished for pressure or vacuum operation. Full details available in Bulletin 560.
465d *Day Co.

Dust Filters.....Sly dust filters can be installed in a limited space, even where inside ceiling height is as low as 12 feet. Compact, economical, easily accessible. Request Bulletin 98.
486 *W. W. Sly Mfg. Co.

Dust Separators.....Exclusive Day design provides high efficiency with low horsepower requirements. For complete details on Dual-Clone dust separator, company makes available Bulletin 49DC.
465b *Day Co.

Dust Separator, Centrifugal.....12 p. bulletin 576 discusses design improvements and applications of heavy duty cyclonic dust separator. Air flow resistance and dust recovery curves included.
465c Day Co.

Filters.....Company supplies filters to give you the exact degree of continuous micronic clarity you need—filter elements and containers available in many different materials. Literature.
16 *Commercial Filters Corp.

Filters, Air.....Model F electronic precipitator delivers uniformly clean air around the clock, with continuous self-cleaning. Bulletin 250 gives complete product information on this air filter.
120 *American Air Filter Co.

Filter, Automatic Valveless.....Permutit Automatic Valveless Filter tells about new gravity flow unit that eliminates instrumentation and auxiliaries, reduces manpower and maintenance to minimum.
490A Permutit Co.

Filters, Disc.....Special patented design of segments in filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive with no blow-back. Details in Bulletin FG-B1.
381f *Denver Equipment Co.

Filters, Leaf....."Multi-Matter", informational house organ, contains series of articles on the importance of properly designed filter leaves. Current issue and Catalog # 57 are available.
480 *Multi-Metal Wire Cloth Co.

Filters, Pipe Line.....New small, low pressure pipe line filters for pressures up to 40 psi for gas or compressed air provide two separate cleaning actions, low resistance, reduced weight. Bul. 210.
490B Dollinger Corp.

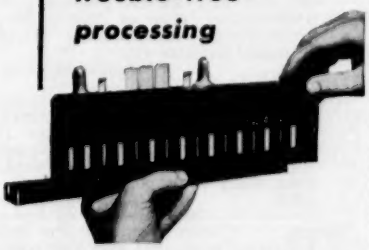
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TAYLOR COMPARATORS

***Help you maintain* UNIFORM**

pH, CHLORINE LEVELS

for trouble-free processing



Accurate, on-the-spot colorimetric tests for pH, chlorine, bromine, phosphate, QAC, nitrate and metal ions made with Taylor Comparators give you dependable operational data in minutes . . . help you maintain proper control of chemical processes, water purification, boiler water, waste treatment.

Determinations are made in only three easy steps. Every set includes complete instructions, all necessary equipment.

COLOR STANDARDS GUARANTEED

Be sure to use only Taylor reagents and accessories with Taylor Comparators to assure accurate results. All Taylor liquid color standards carry an unlimited guarantee against fading.

SEE YOUR DEALER for Taylor sets or immediate replacement of supplies. Write for FREE HANDBOOK "Modern pH and Chlorine Control". Gives theory and application of pH control; illustrates and describes full Taylor line.



W. A. TAYLOR AND CO.
414 RODGERS FORGE RD • BALTIMORE MD

LITERATURE . . .

Filter, Small In-Line.....According to Bulletin 615, the WJR-1-A line of small filters has been redesigned to increase area 75% without increasing floor space requirements. Carbon steel or stainless steel.
491A R. P. Adams Co.

Filter, Small In-Line.....In Bulletin 506 you'll find dimensions, specs., and typical systems for new higher capacity RL-1 rubber lined and LL-1 lead lined 3½-sq.-ft. filters for corrosive applications.
491B R. P. Adams Co.

Flotation.....More large plants are installing "Sub-A's" for entire flotation job, because they give maximum recovery at a low cost per ton. Simplified continuous operating. Details in Bulletin F10-B81.
381g *Denver Equipment Co.

Grinders, Dispersers, Mixers.....Latest types of mixing, grinding and dispersing equipment for all types of applications is illustrated and described in new brochure #3C now available on request.
491C Charles Ross & Son Co.

Homogenizers & Dispersers.....Homogenizers work at high pressures, by tremendous velocity and energy gradients. Sub-Micron disperser handles pigments-abrasive dispersions. Buls. H-55, SMD-55.
130c *Manton-Gaulin Mfg. Co.

Iomogenizers, Laboratory.....Laboratory homogenizers available on rental basis. Machines for exploring new Gaulin dimension of particle control for improved mixing. Bulletin LH-55.
130b *Manton-Gaulin Mfg. Co.

Magnets.....Company offers free booklet entitled "Magnetic Ideas". All Eriez magnets, used in separating equipment, are non-electric and self-contained. They need no wires or attachments.
97 *Eriez Mfg. Co.

Magnets, Separating....Stearns "Magman" permanent plate magnet has exclusive offset air gap feature to stop tramp iron that ordinary plate magnets can't hold. Complete details in Bul. 1071-B.
404 *Stearns Magnetic Products.

Mills, Ball.....A steel-head ball mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Details in Bulletin B2-B13.
381b *Denver Equipment Co.

Mills, Ball & Pebble.....Of welded steel construction, and furnished in all standard sizes from 18" x 24" to 96" x 144" inclusive, with 9 different drive arrangements. For details, see Bulletins 100-A, 100-B.
419c *International Engineering.

Mills, Colloid.....RE colloid mill is a highly advanced, two-stage design which provides continuous micrometer control for producing superior emulsions or dispersions. Details in Bulletin C-57.
130a *Manton-Gaulin Mfg. Co.

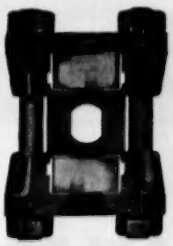
Mills, Grinding.....Traylor grinding mills are available in sizes to meet practically every requirement and are offered in a wide variety of types, including ball, rod, etc. Bulletin 11-121.
13 *Traylor Engineering & Mfg.

* From advertisement, this issue.

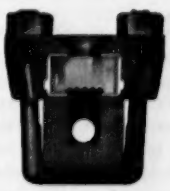
Strahman

HIGH PRESSURE GAUGES

USED IN* REFINERIES *AND* CHEMICAL PLANTS *THROUGHOUT THE WORLD



THRU VISION



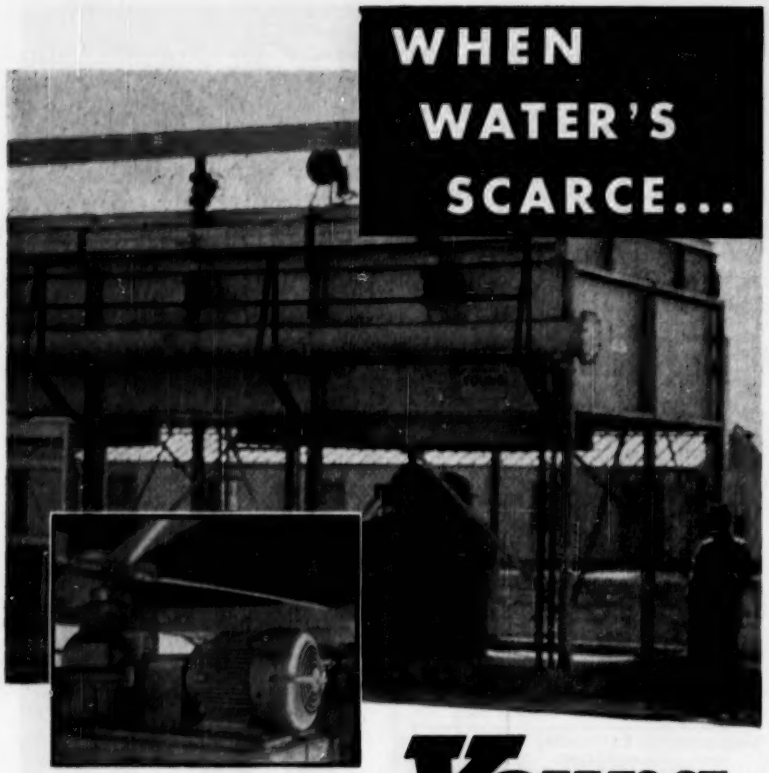
REFLEX
Single or Multiple Sections

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Large Chamber Reflex Gauges
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***SEND FOR* COMPLETE CATALOGUE**

STRAHMAN VALVES, Inc.
16 Hudson St., New York 13, U.S.A.



Fan motors on HC® Units by Young are available with either V-belt drive or gear reducer drive as illustrated.

Young

HC® COOLERS DO THE JOB

If your heat transfer problem is to provide cooling facilities where the use of water is prohibitive because of cost and the existing capacities or availability, look to HC® Units by Young for the answer. These horizontal core units are vertical air discharge coolers for oil, water, chemicals, compressed gas, and also condensers for petroleum vapors, chemical vapors and steam.

HC® Units by Young have unlimited cooling capacities when used in parallel combinations. Round tube core HC® Units are recommended for the following normal operating capacities: Temperature, 350° F.; Pressure, (water and oil) 150 psi, (gas, vapors and steam) 2,500 psi. Special constructions are available for higher pressure and temperature operating conditions.

As specialists in the heat transfer field, the Young Radiator Company will help you with any cooling or condensing problem you may develop.

"WHERE QUALITY COUNTS"

Write to Dept. 317-J for catalog No. 550.



Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

LITERATURE . . .

Mills, Hammer.....Crushes, grinds, shreds to finished sized in one operation; reduces production costs up to 50%; saves up to 75% on equipment cost. Company makes details available in complete catalog.
99 *Williams Patent Crusher.

Mills, Hammer.....Reduce to 20 mesh. Swing-Sledge mills crush moderately hard material up to 70 tph. Hinged-Hammer pulverizers crush softer material up to 30 tph. For information, Bul. 084.
410d *Sturtevant Mill Co.

Mills, Ring Roll.....Reduce hard or soft 1½ in. & smaller material to from 6 to 200 mesh. Grind only—no screens. Capacities of 3 models range up to 18 tph, depending on model & material. Bulletin 079.
410c *Sturtevant Mill Co.

Mist Collectors.....Electro-Staynew mist collectors remove over 90% of oil mist and smoke, possess unit construction, ease of installation, demountable components, safety features. Bulletin 420.
492A Dollinger Corp.

Mixer....."A New Star is Born" outlines advantages offered by the new T. L. Smith turbine-type mixer. It blends solids or solids and liquids with greater speed and completeness than ever possible before.
492B T. L. Smith Co.

Mixers.....Choose the mixer that best suits your needs and available space—three basically different drive types with interchangeable companion sizes in complete fluid mixer assemblies. Catalog.
132 *Philadelphia Gear Works.

Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process. Bulletin B-107.
155h *Mixing Equipment Co.

Mixers.....Bulletin 1483 covers complete lines of double-arm, spiral-ribbon and vertical mixers for use in laboratory, pilot plant or commercial production. Units available in wide range of capacities.
492C Capitol Products Corp.

Mixers, Batch.....Gruendler line of tilting batch mixers is constructed to handle a variety of materials and capacities. Available in many sizes and interior finishes. Bulletin B-12.
TL 507 Gruendler Crusher & Pulverizer.

Mixers, Fluid.....Company offers a condensed catalog which shows all types of their fluidmixers; they promise efficient, dependable mixing without guesswork. Request Catalog B-109.
155f *Mixing Equipment Co.

Mixers, Laboratory.....You get as much as 20 years' service from a Lightnin Laboratory Mixer. Can run Model F at any speed up to 1600 RPM. Four other models to choose from. Bulletin B-114.
155e *Mixing Equipment Co.

Mixers, Pipeline.....Nettco Flomix for continuous pipeline mixing, increased product uniformity, simplified piping layouts. Suitable for high capacities, pressures and temperatures. Bulletin 531.
118d *New Eng. Tank & Tower Co.

* From advertisement, this issue.

Mixers, Portable.....Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. Catalog B-108.
155c *Mixing Equipment Co.

Mixers, Portable & Tripod.....Nettco portable and Flange-Mounted mixers furnish drip-proof construction, high or medium speed, top efficiency drive, oversized bearings, etc. Specification Sheets.
118c *New Eng. Tank & Tower Co.

Mixers, Side Entering.....Company can furnish either standard packed stuffing box or mechanical seals. On most standard types either seal can readily be converted to the other, as desired. Bulletin 72-B.
419a *International Engineering.

Mixers, Side Entering..... Standard units available in 1/3 to 30 HP sizes, offering a variety of speed reduction designs, motor mounts, stuffing box modifications, etc. Request Bulletin 532.
118b *New Eng. Tank & Tower Co.

Mixers, Side Entering..... Furnishes detailed information on features, typical applications, mechanical design, maintenance, shaft seals, methods of installation, etc., in Catalog B-104.
155d *Mixing Equipment Co.

Mixers, Tank Top.....Model WT and Model T tank top agitators feature clean, efficient designs with minimum moving parts. Variety of motors, shafts, stirrers and supports. Bulletin 551.
118a *New Eng. Tank & Tower Co.

Mixers, Top Entering..... Illustrated 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. Catalog B-102.
155a *Mixing Equipment Co.

Mixers, Top Entering.....Makes available pertinent information on top-entering mixers (propeller type) . . . for closed tanks, pressure & vacuum . . . for open & loose-covered tanks. Catalog B-103.
155b *Mixing Equipment Co.

Mixers & Blenders.....Design features and specification tables are given in a new 4-page Bulletin 557 on mixers, blenders, sifters and roll mills. Tables give pertinent dimensions, capacities and horsepowers.
493A Cleveland Automatic Mach. Co.

Mullers.....If you mix dry or semi-solid materials, "Mulling in the Chemical & Process Industries" will show you why and how Simpson Mulling can do a better, faster and more thorough blending job.
407 *Simpson Mix-Muller Div.

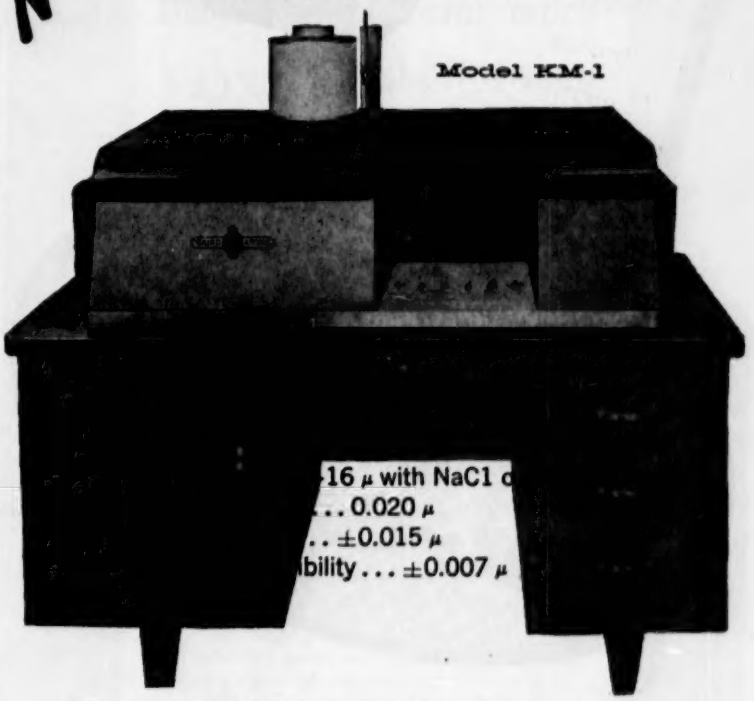
Presses, Filter.....Sperry filter presses can speed your production and improve product quality at lower costs, company states. Complete information in Sperry Filtration Catalog.
365 *D. R. Sperry & Co.

Presses, Filter.....Shriver has a long record in solving problems of filtration, washing, extraction or thickening, with the kind of filter press best suited to specific conditions. See data book.
489 *T. Shriver & Co.

* From advertisement, this issue.

NEW... AN EXPANDABLE

infrared double-beam
RECORDING SPECTROPHOTOMETER



BAIRD-ATOMIC's new KM-1 Spectrophotometer is the first expandable double-beam instrument in the infrared field — resolution and quantitative accuracy can be increased by the addition of "expandability" kits. This outstanding instrument is a result of B-A's 20 years of research and development — it is ideal for: routine laboratory analyses, production control, raw material inspection, etc.

The outstanding features of the KM-1 are:

- Speed and Performance
- High Resolution and Accuracy
- Expandability and Versatility
- Prism Interchange
- Linear to wavelength or Linear to wavenumber recording
- Simplicity of Operation and Maintenance
- Compact, Rugged Construction

Open sampling compartments permit ready access to both sample and reference beams. Special design features permit use of all B-A accessories including 1-meter cells.

The KM-1 is a medium-priced instrument with excellent resolving power and high quantitative accuracy.

BAIRD ATOMIC

Technical data available on request.

Baird-Atomic, Inc.

33 UNIVERSITY ROAD, CAMBRIDGE 38, MASS.



Newark Wire Cloth is made of *all* malleable metals such as aluminum, brass, bronze, phosphor bronze, copper, monel, Nichrome, nickel and stainless steel; as well as the noble metals such as gold, silver, platinum, etc.

This wide range of metals enables you to select the *one* wire cloth to meet your conditions of corrosion and/or contamination.

In all metals, Newark Wire Cloth is accurately woven in a wide range of meshes, ranging from very coarse (4 inch space cloth), to extremely fine (up to 400 mesh). Our reputation for 'Accuracy' through more than 75 years is your guarantee of wire cloth quality.

We maintain a large stock of popular sizes in the more commonly used metals and can make prompt shipment. Let us quote on your requirements.

Send for our New Catalog E.

Newark Wire Cloth COMPANY

351 VERONA AVENUE • NEWARK 4, NEW JERSEY

LITERATURE . . .

Process Equipment.....New 12 p. booklet "An Open Door" shows how Swenson can assist in solving your processing problems. Planning, surveillance of operation, post-installation checks.
203 . . . . *Swenson Evaporator Co.

Process Equipment.....Ruggles-Coles pilot plant rotary dryer is designed especially for laboratory use or for small capacity unit operations requiring a drying step. Bulletin AH-473.
468 *Hardinge Co.

Process Equipment.....General 8-page Bulletin G3-B60 shows latest improved models of process equipment for the chemical, processing, mining and milling industries; rubber covering service; engineering service.
494A Denver Equipment Co.

Propellers, Fabricated ..... "Fabricated" propellers will do a perfect job of mixing, blending, stirring, pumping or aerating in applications requiring relatively low horsepower and not over 1750 LPM. Catalog.
B498 *Michigan Wheel Co.

Rolls, Crushing.....Reduce soft to hard 2 in. & smaller material to from 12 to 20 mesh with minimum fines. Eight sizes: rates to 87 tph. Types available: Balanced, Plain Balanced, & Laboratory Rolls. Bul. 065.
410e *Sturtevant Mill Co.

Samplers, Automatic.....Heavy duty units, extra rigid track and ball-bearing wheels assure positive travel and timing of sample cutter. Available in stainless steel. Full details available in Bulletin S1-B4.
381e *Denver Equipment Co.

Screening Equipment ..... Company offers screens for every water, sewage and industrial waste: coarse screens for removal of large solids and fine screens for removal of small solids. Book 2587.
494B Link-Belt Co.

Screens, Vibrating....."Symons" Type F horizontal, vibrating screens—screening action controls flow of material, accurate sizing, require minimum headroom, range of deck combinations. Bulletin 248.
494C Nordberg Mfg. Co.

Sifters.....Thousands of products, wet or dry, from flour to wood chips, are sifted through efficient, low-cost, high-production Ro-ball sifters. Many models available. Day Ro-ball Bulletin.
377 *J. H. Day Co.

Softeners.....Company has pioneered with versatile Hot Process Softener and Hot Zeolite, which provides zero hardness, lowers solids in medium and high pressure boilers. Publication 4801.
397 *Cochrane Corp.

Vaporizers.....Engineers analyze entire process system before recommending the proper high-temperature, low-pressure vaporizer. They design, build, install and service vaporizers. Bul. ID-54-5.
123 *Foster Wheeler Corp.

Wire Cloth.....Catalog describes company's facilities for fabricating wire cloth parts. Wire cloth parts for screening, filtering and special uses. Provides useful metallurgical data. Request your copy.
378 *Cambridge Wire Cloth Co.

* From advertisement, this issue.

Wire Cloth.....Wire cloth made of all malleable metals such as aluminum, brass, bronze, phosphor bronze, copper, monel, Nichrome, nickel and stainless steel. Company offers Catalog E.
494 *Newark Wire Cloth Co.

Wire Cloth.....Illustrated within new 94 page catalog is complete line of industrial wire cloth, screens and wire cloth products. Completely new section gives standard trade definitions and ordering information.
495A Cambridge Wire Cloth Co.

Wire Cloth & Screen.....In order to improve your filtering, straining, sizing operations, specify Ludlow-Saylor wire cloth & screen. Complete details in Condensed Screen Reference Catalog.
469 *Ludlow-Saylor Wire Cloth.

Pumps, Blowers, Compressors

Compressors.....New WN-224 compressor with compact, semi-radial design is delivered as a package, completely assembled and ready to go. Capacities 2418 to 6048 cfm, horsepower 350 to 100. Bul. 179-11.
7 *Joy Mfg. Co.

Fans.....Company offers full details on Type BL fans for industrial air-moving, featuring long life, full rated delivery on the job, quiet operation and easy installation. Bulletin F-102.
90 *Buffalo Forge Co.

Fans, Air.....New 24-page Air Engineering Data File, Bulletin E-57, covers engineering and test facilities for propeller fans. Bulletin also covers specifications, construction, maintenance and installation.
495B Aerovent Fan Co.

Fans, Centrifugal.....Company offers a complete line of centrifugal fans with quiet, efficient Air-foil Blading for all-purpose applications; up to 700,000 CFM. Series 8000, Catalog 1121.
33[illegible]-7 *Westinghouse Electric Corp.

Fans, Exhaust.....High air delivery per horsepower required. Statically and dynamically balanced; designed exclusively for dust control applications. Company makes complete details available in Bul. 471.
465e *Day Co.

Fans, Propeller.....New fan sizes, revised air deliveries, specifications, performance data and dimensional drawings on the entire Hartzell line of fans are contained in revised catalog, Bulletin A-109C.
495C Hartzell Propeller Fan Co.

Pumps.....Handle most anything that can pass through a pipe, from free-flowing liquids to non-pourable pastes—materials containing relatively large particles or abrasives. Details in Bulletin 30-CE.
385 *Robbins & Myers.

Pumps.....Taber pumps are built for handling chemical solutions, efficiently and economically . . . in the processing industries. Details on horizontal pumps in Bulletin C-355, and vertical pumps in Bul. V-837.
L487 *Taber Pump Co.

* From advertisement, this issue.

DURABLA contains more high-grade asbestos than any other gasket material

Durabla Asbestos Sheet Packing, produced and marketed for almost 50 years, can be used with proved safety wherever gaskets are required. It is the one gasket material suitable for the widest range of temperature-pressure combinations.

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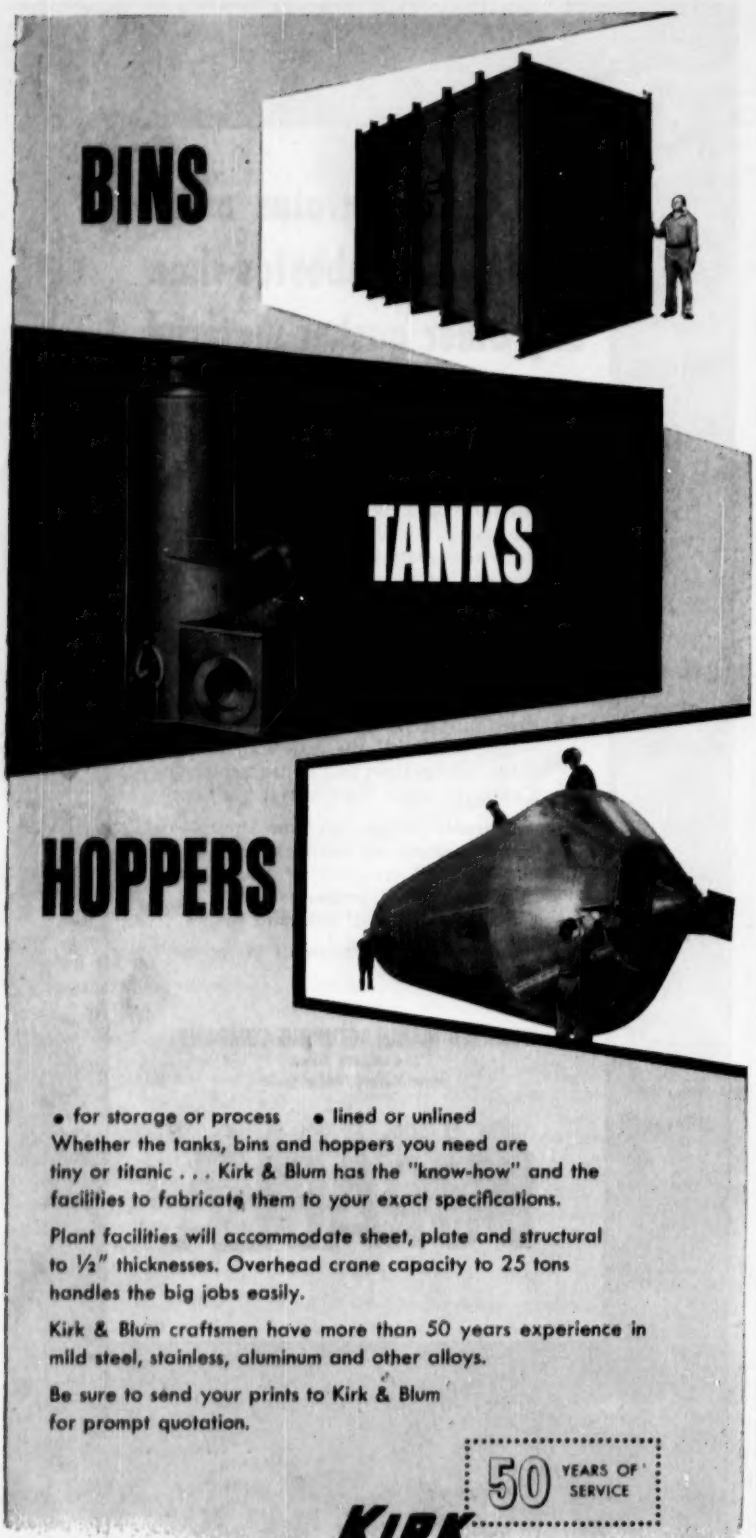
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DM-20



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LITERATURE . . .

Pumps.....If you have a problem where metering, blending or other accurate pumping of liquids is concerned let Viking help solve it. Use Viking pumps for accurate pumping. For information, Bulletin 57Sc.
T499 *Viking Pump Co.

Pumps ..... Company manufactures pumps for every liquids handling job in industry. Many models of Aurora turbine-type pumps and Aurora centrifugal pumps are described in Condensed Catalog M-55.
T503 *Aurora Pump Div.

Pumps.....Type SVC process pump discussed in bulletin is water cooled for operation above 800 F. with capacity range of 15 to 3,000 gpm. at 600 psig. and differential head of 700 ft. Request Bul. 137.
496A Pacific Pumps, Inc.

Pumps, Acid.....Mighty midget for pumping acids. Jabsco neoprene-impeller pump made of Ace hard rubber outlasts, out-pumps anything in its pressure, size and price class. Full details in Bulletin 97-A.
340c *American Hard Rubber Co.

Pump, Airlift.....Airopump air lift pump described in company's Bulletin 2257548 is a unit designed specifically for low lift applications peculiar to sewage and industrial waste treatment processes.
496B Walker Process Equipment.

Pumps, Centrifugal.....Vertical wet pit centrifugal pumps save floor space, require no priming—no costly liquid leaks as stuffing boxes are not under liquid pressure. Full details available in catalog.
357 *Yeomans.

Pumps, Chemical ..... Lapp Pulsafeeder is a combination piston-diaphragm pump for controlled-volume pumping of fluids. Typical applications, description and specifications available in Bulletin No. 440.
303 *Lapp Insulator Co.

Pumps, Chemical.....Reliability and maintenance economy are featured in Philadelphia Type S pumps for 85% of all chemical pumping needs. Can handle corrosives, slurries, etc. Request Bulletin S-1254.
383 *Philadelphia Pump Div.

Pumps, Diaphragm.....A New Concept in Precision Metering and Proportioning of Fluids", containing schematic drawing and description, discusses new McCannameter diaphragm pump. Booklet # 301.
371 *Hills-McCanna Co.

Pumps, Double Suction.....Hydraulically balances, efficient and durable, in sizes to deliver from 10 to 14,000 gpm for circulating, air conditioning, other plant services. Details in Bulletin 955-Q.
102a *Buffalo Pumps.

Pumps, Duplex Steam.....New Bulletin WS-18 presents information about Wagener Type U duplex steam pumps. Includes most popular models and specifications for a wide range of sizes. Section drawings.
496C Canton Stoker Corp.

Pump, Glassed ..... New corrosion-resistant pump is described in bulletin 725.2. Available in heads up to 140 ft., capacities up to 700 gpm. Handles alkalis and acids except hydrofluoric.
342 *Goulds Pumps Co.

* From advertisement, this issue.



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Write for Bulletins CP551 and 575

CHEMICAL & POWER PRODUCTS, Inc.

5 Broadway, New York 4, N. Y.

LITERATURE . . .

Pumps, High Vacuum.....Kinney high vacuum pumps and high vacuum systems, including mechanical booster pumps and oil sealed mechanical pumps, increase production and lower costs. Literature.
325 *Kinney Mfg. Div.

Pumps, Industrial .....Jabsco Industrial Pumps; instantly self-priming; simple, compact, only one moving part; durable neoprene impeller; self-lubricated; trouble-free operation. Catalog sheets available.
TR501 *Jabsco Pump Co.

Pumps, Liquor ..... Warren liquor pumps—Types "L", "LS" and "A"—for pumping erosive and corrosive liquids, hot or cold. They are engineered for results and economical. See Bulletin 245.
497A Warren Pumps Inc.

Pumps, Metering & Proportioning..... Catalog covers Model "U" and "K" metering and proportioning pumps, the Hills-McCanna-meter and Model 4411 chemical pump. Request copy of Catalog 602.
497B Hills-McCanna Co.

Pumps, Multistage ..... Type "RR" Multistage pumps are highly efficient for high pressure applications with clear water, ideal for boiler feed service. Write for full details in Bulletin 980-D.
102C *Buffalo Pumps Div.

Pumps, Multistage Centrifugal..... Types A, AC, OV and UNI multistage pumps for high temperature, high pressure, heavy duty service are covered in new Bulletin 128 for sizes from 2 to 8 in.
497C Pacific Pumps.

Pumps, Process.....Type SVS centrifugal pump is designed for most advantageous application of the mechanical shaft seal. Rated 15 to 1,300 gpm. at pressures to 600 psi., it's designed for easy servicing.
497D Pacific Pumps.

Pumps, Proportioning ..... Features which contribute to the exceptional feeding accuracy, positive feed rate setting, and initial and operating economies of Proportioneer described in Bulletin 1140.
372 Proportioneers, Inc.

Pumps, Rotary Gear....."How to Solve Pumping Problems" completely covers use of rotary gear pumps for moving liquids. Descriptive material about equipment is supplemented with general technical data on pumping.
497E Geo. D. Roper Corp.

Pumps, Screw.....The pitch of the screws, along with the full load speed of the motor, determine the capacity of the Warren screw pump. Standard pumps in all machinable metals. Bul. S205.
490 *Warren Pumps Inc.

Pumps, Single Suction.....Outstanding features of Buffalo single suction pumps are: oversize bearings to handle speeds up to 5000 rpm, sealed-in bearing housing, enclosed impellers. Bul. 976-E.
102b *Buffalo Pumps Div.

umps, Submersible.....New Johnston submersible pump Bulletin 1020 describes submersible pumps with 4 to 7 in. bowls and with horsepower ratings to 20 hp. and capacities ranging up to 375 gpm.
497F Johnston Pump Co.

* From advertisement, this issue.

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METALLO Metallic RASCHIG RINGS are supplied in all workable metals. We will be happy to furnish full details on the properties of these Rasching Rings in any metal specified. QUALIFIED METALLURGISTS ON OUR STAFF WILL PRODUCE PROPER ALLOYS FOR YOUR APPLICATIONS.

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STYLE SSP
No. 304 stainless steel plate welded to stainless steel hub, polished completely to "Dairy FINISH"



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No. 1010 steel plates welded to hexagon hub. Thoroughly suitable for all applications in which iron or cast steel propellers would otherwise be used.

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NOW, for the first time in history, you can obtain "fabricated" propellers so accurately balanced and pitched they will do a perfect job of mixing, blending, stirring, pumping or aerating in any application requiring relatively low horsepower and not over 1750 RPM. Our very specialized, recently developed process of fabricating these wheels results in real cost-savings, considerably lower prices to our customers and far quicker deliveries. They are available in all standard sizes from 6" thru 24" diameters, right and left turning . . . in stainless steel polished to a "Dairy Finish" and 1010 Steel. If you are using wheels in these categories by all means investigate the new MICHIGAN FABRICATED PROPELLERS. It's bound to pay you big dividends in time and money savings. Write for your free copy of our new INDUSTRIAL PROPELLERS CATALOG.

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GRAND RAPIDS 3, MICH.

LITERATURE . . .

Pumps, Vacuum.....Beach-Russ combination "two-stage" vacuum pump gives tops in service at the low micron range. Faster pump-down, faster recovery, lower blank-off pressure. Ask for Bulletin 95.
L504 *Beach-Russ Co.

Rotary Pumps & Pump Motors..... Catalog 957 contains information about rotary pumps for manufacturing, marine, petroleum and process industries and on motors for high-torque, low-speed transmission.
498A Geo. D. Roper Corp.

Services, Processes, Misc.

Backstand, Paper.....Product Bulletin EG71 tells how automatic edge position control can be obtained on film, paper, foil, etc., by replacing the backstand with Model 360 light duty backstand. Available on request.
498B Askania Regulator Co.

Baffle, Remote Control.....A new remote control baffle for fume hoods is operated from an outside control panel. Can be quickly adjusted for any desired air flow aperture in safety. TD 1262.
36f *U. S. Industrial Chem. Co.

Cleaning Process Equipment.....Use in-place chemical circulation to clean towers, tanks, pumps, compressors, lines, fittings and other process equipment quickly, safely. Technical Bulletin.
R505 *Oakite Products Inc.

Construction.....Four-page brochure describes methods for high quality steel plate construction used by this reputable firm. Illustrations show actual units being erected on field sites.
498C Chicago Bridge & Iron Co.

Construction Tank.....New 16 p. brochure outlines operations and services of this fabricator. Brochure describes technical advances in fabrication of stainless steel and high-temperature alloys.
498D Portland Copper & Tank Wks.

Construction & Design, Acetylene..... Company has designed and built facilities for production of more than 150,000,000 pounds of acetylene per year, including world's largest plant. Bul. 257.
207 *Chemical Construction Corp.

Electroplating.....Nine ways to improve electroplating discussed in new booklet. Shows how to cut costs by selection of proper compound, use of titrations, tips on rinsing, etc.
498E Diversey Corp.

Engineering Services, Furnaces..... Nichols Herreshoff and Bethleham Wedge furnaces serve industry by treating materials ranging from activated carbon to zircon sand. Buls. BF-1 and 233.
318 *Nichols Engrg. & Research.

Engineering Shortcuts.....Included in booklet "Time Saving Tips for the Draftsman and Engineer" are 59 shortcuts to speed drafting and computation work. Based on interviews with leading engineers and draftsmen.
498F Frederick Post Co.

* From advertisement, this issue.

Engineering & Construction.....Illustrated booklet gives quick but comprehensive look at Blaw-Knox operations. Shows products engineered and fabricated for construction and chemical industries.
499A Blaw-Knox Co.

Eye Protectors.....Illustrated bulletin lists plastic eye protective equipment, including methacrylate lenses in safety spectacles, eye shields, clip-ons, cover goggles and face shields. Bul. 200.
499B *Watchemoket Optical Co.

Fume Hoods.....New improvement gives you complete air flow control inside the fume hood by remote control. You can move the baffle by remote control and change the air flow with one motion. Bul. 56H.
467b *Laboratory Furniture Co.

Furniture, Laboratory.....Company offers valuable free planning aid, revised edition of "Steelab" with hundreds of useful ideas for laboratory furniture layouts. Request your copy now.
467a *Laboratory Furniture Co.

Hydraulic Equipment.....Complete product information and engineering data on hydraulic pumps, fluid motors, aircraft-type pumps and servo systems is found in new 16-page illustrated Bulletin 810.
499C Eastern Industries.

Laboratory Equipment.....Up to the minute listing of the latest in polyethylene laboratory ware contained in new 19 p. catalog. Fully illustrated; prices for both small and bulk orders.
499D Harshaw Chemical Co.

Laboratory Equipment.....16 p. catalog features new developments along with standard equipment. Electro-balance, photomicrography illuminator, AC line-operated spectro-photometer among items offered.
499E Will Corporation.

Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, agitators, pulp distributors, feeders, etc. Request company's Bulletin LG3-B10.
381i *Denver Equipment Co.

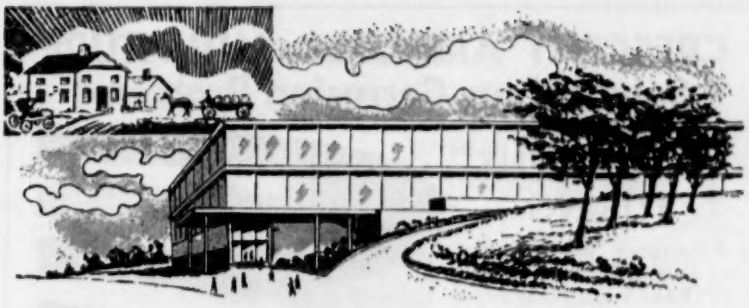
Laboratory Equipment & Furniture.....Sectional units designed for interchangeability & flexibility assure a synchronized installation for peak efficiency. 180 p. Catalog 4B & Supplement 55-A.
332 *Metalab Equipment Corp.

Laboratory Fixtures.....Catalog PF-57 has heavy-duty fixtures for gas, air, vacuum, tap and distilled water. Features line of forged bronze-alloy needle valves for pressures up to 1,000 psi.
499F Laboratory Furniture Co.

Laboratory, Processing.....Buflovak laboratory has solved over 7000 processing problems. This thorough research has led to many new methods in the chemical and allied fields. Catalog 358.
388-D *Blaw-Knox Co.

Laboratory Services.....10 p. bulletin E-571 outlines services to mineral processing industry; investigation of ores, flow sheet development and plant design and construction.
499G Southwestern Engineer. Co.

* From advertisement, this issue.



WILL YOUR PUMPING BE MODERN TOO?

When modernizing your plant and equipment, you can cut costs by installing positive displacement Viking Rotary Pumps. You can pump liquids ranging from LP-Gas to tar and molasses with self-priming Vikings. You can eliminate uncertain, troublesome gadgets, extra piping, auxiliary equipment, etc.

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See our Catalog in Sweets Plant Engineers File

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Materials: All Stainless Steel—Type 316

Physical Dimensions: 90" H x 16" W x 20'9" L

Outside Tubes: 4" O.D. and 11 Ga.
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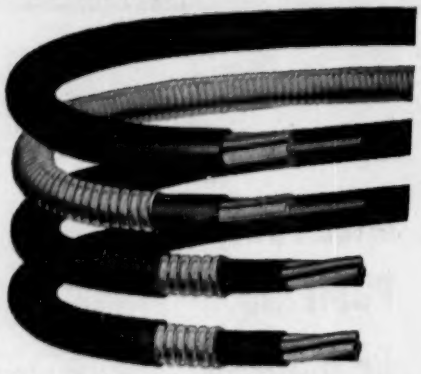
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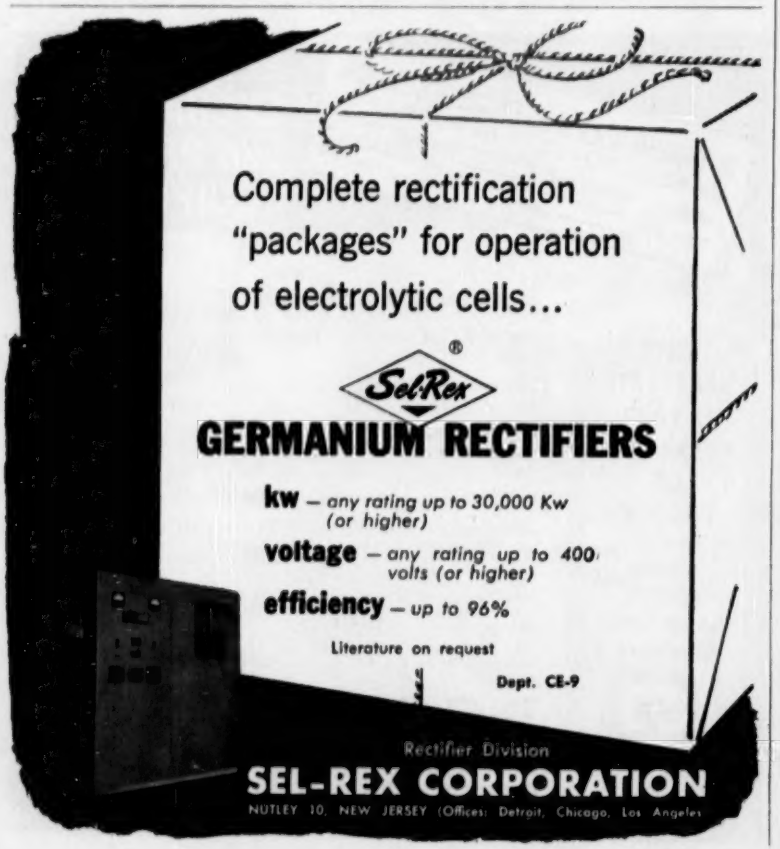


A corrosion proof sheath of Polyvinyl chloride over SPIRALLY CABLED copper or aluminum instrument tubing provides complete moisture and corrosion protection for the tubes. Flexible galvanized steel armor in various combinations, as shown, gives mechanical protection for permanence with handsome savings in installed cost.

Available in size ¼" O.D. in lengths to 1000 feet in from 2 to 37 tubes. Licensed under U. S. Patent #2,578,280. **SEND FOR BULLETIN 356-H**

Plastic Coated Single Tubes, copper or aluminum, should be used to give corrosion protection to all single lines up to the final tube fitting, where trouble from corrosion may occur.

CRESCENT
INSULATED WIRE & CABLE CO.
Trenton, N. J.



LITERATURE . . .

Manipulator, Tubing.....An external manipulator for tubing applies pressure externally on a flexible tube, producing a continuous metered flow of liquids as low as 0.1 cc. per day. TD 1269.
36m *U. S. Industrial Chem. Co.

Models, Crystal..... Crystal lattice models of elements, minerals, and alloys listed in 6 p. bulletin. Based on data from X-ray and electron diffraction; magnification is 250 million-fold.
500A Arthur S. LaPine.

Percolation Processes..... Technical bulletin 401 gives data on adsorbants, yields and economics for static-bed percolation. Section also describes developments in continuous percolation.
500B Minerals & Chemicals Corp.

Plastics Molding.....73 p. handbook details basic principles of molding and handling Plaskon urea and melamine molding compounds. Covers storage, preforming, preheating, molding and testing.
500C Allied Chemical & Dye Corp.

Pressure Pickup.....A new pressure pickup, Type 4-316, discussed in copany's Bulletin 1568A, is claimed the first able to operate continuously at 600 F. Operation is based on the strain gage principle.
500D Consolidated Electrodynamics.

Sprinkler Systems, Automatic..... Blaw-Knox engineers, fabricates and installs automatic sprinkler systems that are always alert to detect, confine and quench a fire at its origin. Bulletin 2426.
444a *Blaw-Knox Co.

Surface Treatment.....An 84 p. booklet describes latest developments in surface treatment of metals. Covers rust prevention, mechanical and chemical cleaning, blackening and other aspects.
500E E. F. Houghton Co.

Testing Services.....New 12 p. facilities brochure illustrates plant and equipment facilities along with details of testing services offered to manufacturers of military and commercial equipment.
500F Aerotest Laboratories.

Water Treatment.....Company offers folder on water treatment: importance of water; water treatment by ion exchange; research facilities; types of equipment; terminology; modernization. Request copy.
500G H. M. Mueller Corp.

* From advertisement, this issue

For the latest developments in
Chemicals
Equipment
Processes
you'll find our "Guide To Technical Literature" right up your alley. You can get any bulletin or catalog in this listing . . . and fast. Simply circle the item's number on the Reader Service Post Card and mail.



In the COMPLETE LINE of Jerguson Heated Gages there is a model to meet your specific needs . . . heated by steam or electrically

You can accurately gage heavy or viscous liquids with Jerguson Heated Gages . . . and the line is so complete there is a model to meet your specific problem. Made in Reflex or Transparent styles, in External or Internal Tube models, as well as a large chamber model with dual tubes. Heated by steam, hot fluid, or electrically. Furnished with special jacketed heated-gage valves, union or non-union connections. You get accurate, dependable gaging of heavy or viscous liquids, or protection for cold weather installations.

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cut pumping costs with

JABSCO INDUSTRIAL PUMPS



Model 340
316 S.S. Construction—
1½" Port Size—Sealed Ball
Bearings—Mechanical
Shaft Seal

- INSTANTLY SELF-PRIMING
- SIMPLE, COMPACT, ONLY ONE MOVING PART
- DURABLE NEOPRENE IMPELLER
- SELF-LUBRICATED
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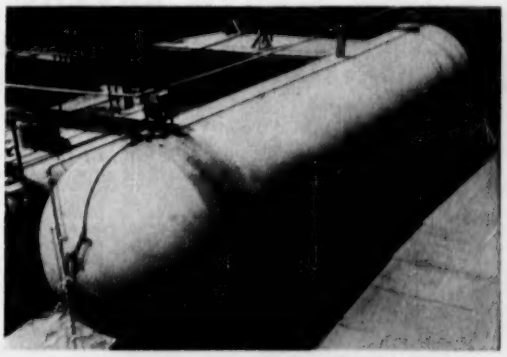
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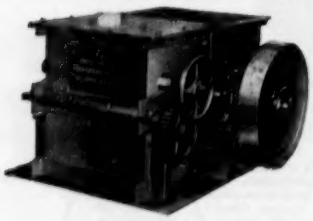
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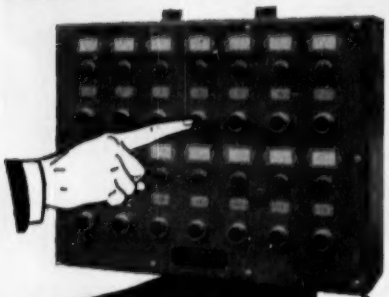
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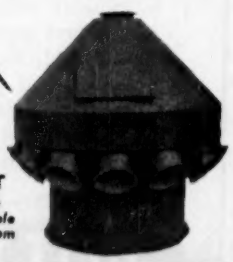
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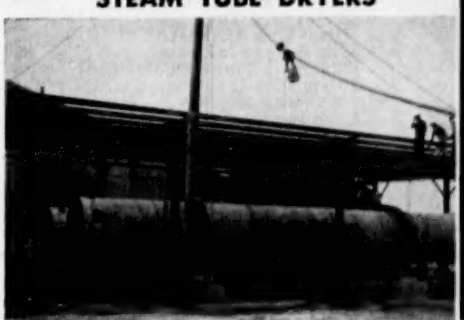
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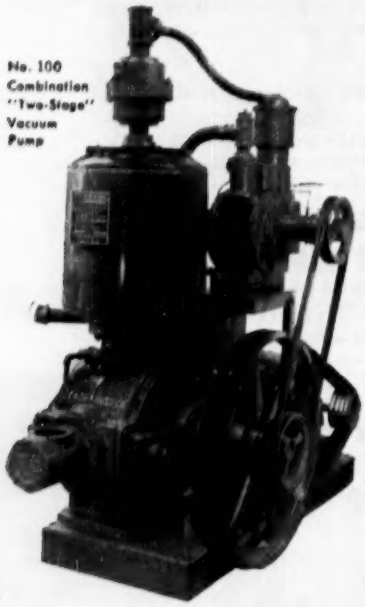
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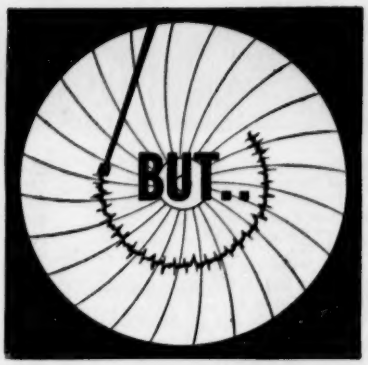
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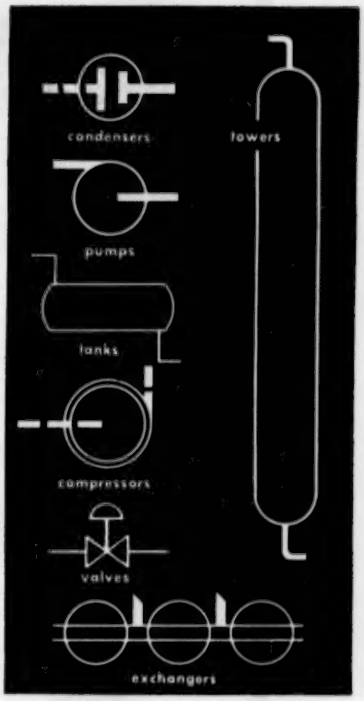
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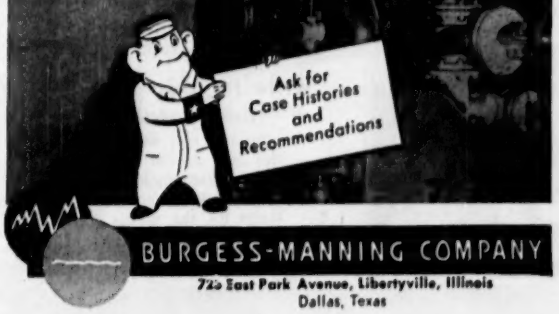
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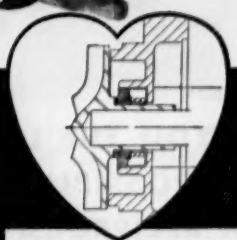
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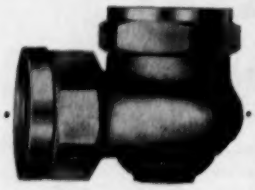
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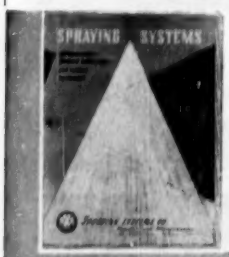


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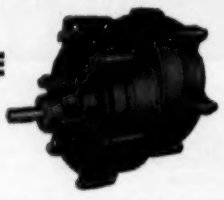


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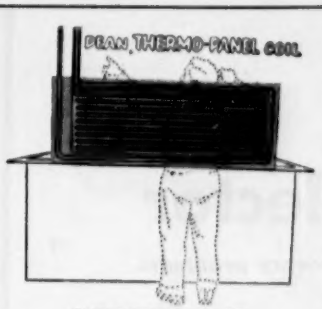
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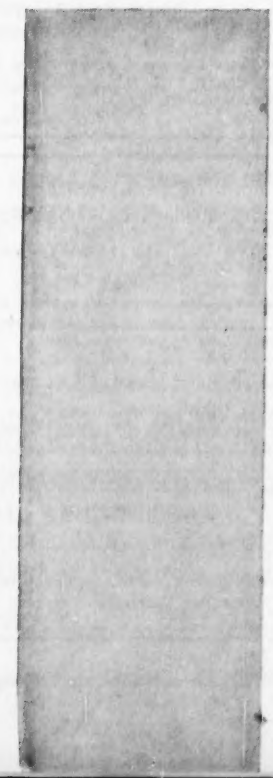
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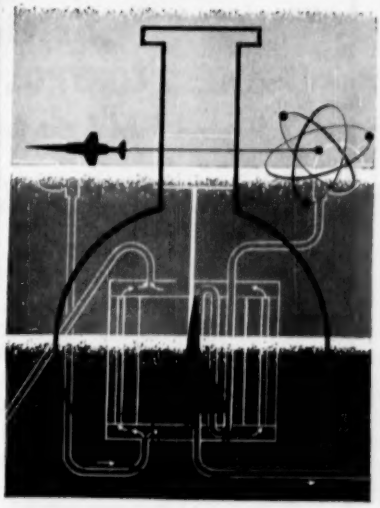
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Applicant should be 35 to 45 years old and should have technical education with extensive operation experience in Refractories industry. Experience in manufacturing of basic refractories desirable but not essential. Applicant should have knowledge through education or previous experience of inorganic chemical process technology.

Please submit replies to **P-5715** CHEMICAL ENGINEERING, Class. Adv. Div., P. O. Box 12, N. Y. 36, N. Y., stating educational background, previous experience, and salary desired.

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Must be experienced in crushing and grinding operations. Midwest location. Old, established, progressive manufacturer. Give full details. All replies confidential. Members of our organization know of this ad.

P-5589, Chemical Engineering,
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Write Personnel Manager

ANSUL CHEMICAL COMPANY
Marinette **Wisconsin**

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To aid in designing and constructing new HF plant in Southwest. Applicant must have intimate knowledge of HF operations. Give details of training, experience and salary requirements. Letter will be treated as confidential.

P-5833—Chemical Engineering
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RW-5896, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

Undisplayed Employment Opportunities on opposite page

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New Pfaudler 3' x 6' Glass Lined Still
Patterson Porcelain lined Pebble Mill 6' x 8'
Mikro Mill #2S-1, serial 5403, extra head.
New Pfaudler Glass Reactor, 3000 gal., Jktd. & Agtd.
Roto Louvre S/S 5'x20' Rotary Dryer, complete
Pfaudler SS Reactor, 125 gal., jktd. & agtd.
Gen. American 42"x120" Twin Drum Dryer
3 Vibrating Sifters 20"x72", with motors
AT&M 36" SS Centrifuge with 15 HP Motor
2 W & P Heavy Duty Jktd. Mixers, 15 gal. 15 HP
W&P 100 gal. SS mixer, sigma arms, 20 HP exp.

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DRYERS

3—American 42" x 120" double drum.
3—Louisville 6' x 50' rotary steam tube.
1—20" dia. x 9' Stainless Steel Rotary.
1—Louisville Dewaterer 8 Roll.

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3—12,000 gal. Stainless Steel Vertical.
2—5000 gal. Stainless Steel Vertical.
2—3500 gal. Stainless Steel Vertical.
1—2000 gal. Stainless Steel Vertical, Jktd. Agtd.
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1—5500 gal. Rubber, Vertical.
15—Copper Vertical 1200 to 12,000 gal.
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7—35,000 gal. Vertical Steel.
28—22,000 gal. Vertical Steel.
3—20,000 gal. Vertical Steel.
2—1800 gal. Vertical, Steel, Agtd.

CENTRIFUGES—FILTERS

1—Bird Solid Bowl 32" x 50" Steel, Continuous Centrifuge.
1—Bird 18" x 28" Stainless Steel, Solid Bowl, Continuous Centrifuge.
1—Bird 40" Suspended, rubber lined Centrifugal.
2—AT&M 42" dia. Suspended Type Centrifugal, Stainless.
2—Tolhurst 40" Suspended Type Centrifugals, Steel.
1—36" AT&M rubber covered, centerslung Centrifugal.
2—Sharples #16 Centrifuge, Steel and Monel.
4—36" x 36" c.i., P&F Filter Presses.
1—36" x 36" wood P&F Filter Press.
1—32" x 32" wood P&F Filter Press.
1—#7 Sweetland Filter, 20 leaves.
1—Sparkler Filter, Type 33-S-28, Stainless steel.
1—Sparkler Filter 14-4 Steel.
1—Oliver 3' dia. Horiz. Monel Filter.
1—Conkey 3' dia. Rotary Filter.

CENTRIFUGAL PUMPS—STAINLESS, BRONZE & IRON

1—Lawrence 3" Vertical 316 Stainless.
1—Moyno Pump Type CDR.
3—La Bour 1½" to 3" Stainless.
2—Wilfley 4" Haveg Lined.
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1—Christie 6' x 40' Rotary Dryer
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1—Allis-Chalmers Type B, 24" x 12" Jaw Crusher
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1—Abbe Eng. 6' x 15' Silex Lined Tube Mill 75 HP motor
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2—Devine 5' x 33', 4' x 25' Rotary Vac.
1—Devine 5' x 10' Rotating Vacuum.
1—Hersey 1½' x 12' Rotary, 304 S.S.
3—Louisville Steam Tube 6' x 50', 6' x 35', 38" x 25'.
2—Buflovak Atmospheric double drum 42" x 120", variable speed drive.
1—Buflovak 5' x 12' Atmos. single drum.
2—Devine 4' x 9' Atmospheric single drum.
4—Tray Dryers, steam heated, 95 sq. ft.

FILTERS

1—Shriver 30" P&F., 304 S.S. 20 Chambers.
5—Sparkler 33-S-28, 150 sq. ft., 304 S.S.
1—Sparkler #14-D-4, 304 S.S. NEW.
1—Oliver Rotary, Monel 8' x 10'.
1—Oliver 3' dia. Monel Horizontal.
1—Oliver 5'3" x 8' Steel Rotary Vac.
1—Elmco 18" x 12" 316 S.S.
2—Sweetland #12, 48 and 32 leaves.
1—Sweetland #7, 20 S.S. covered leaves.
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2—Bird 40" suspended, 347 S.S.
1—Bird 40" suspended, rubber.
3—Tolhurst 40", 32", 26", suspended.
1—AT&M 40" suspended, steel.
1—AT&M 36" center slung, rubber covered, perforated basket.
1—Tolhurst 32" Suspended, 304 S.S., perforated basket.

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1—Artisan 450 sq. ft., 304 S.S., single effect Evaporator, complete with piping, receiver, separator and condenser.
1—Nooter 1000 gal. nickel-clad, jacketed, agitated Reactor.
2—Pfaudler 250 gal. glass lined, jacketed, agitated Reactors.
3—Pfaudler 500 and 300 gal., glass lined jacketed Reactors.
1—600 gal., 316 S.S. jacketed, agitated Reactor 200# internal pressure, 75#.
4—3500 gal., 304 S.S. jacketed, agitated.
1—Wyatt 18" dia. x 23', 316 S.S. Bubble Cap Column.
1—Wyatt 24" dia. x 42', 304 S.S. Bubble Cap Column.
1—10' dia. Hortonsphere, 225 psi.
1—10,000 Aluminum Storage Tank 10' x 16' x ½" shell, 25# W.P.
1—12,000 gal. Horizontal rubber lined Tank 10'6" x 17'4".
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1—Devine 5' x 10' steel jacketed Ball Mill.
1—National 6" x 12" Mill, Two Roll.
1—Kent 6" x 14" Three Roll Mill.
3—Gayco Air Separators 16', 6', 18".
3—Mikro Pulverizers, Bantam, #1SH #1DH, 2TH.
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3—#34 Robinson Triple Deck 30" x 104".
6—#42 Rotex Double Deck 40" x 84".
3—#421 Rotex single deck 60" x 84".
3—Robinson single deck 40" x 84", 304 S.S.
1—Patterson single deck 40" x 84", 304 S.S.
2—Tyler Hummer single deck 3' x 5', 3' x 10', 3' x 12' with Thermionic Units.

MIXERS

1—Baker Perkins #15USE, ALL STAINLESS Double Arm, jacketed, Vacuum.
1—Baker Perkins #15VUMM, 100 gal. jacketed, 100 HP.
2—Baker Perkins #17DAM, 200 gal. jacketed, Sigma Blades.
1—Baker Perkins 50 gal. jacketed, Sigma Blades.
5—Day "Cincinnatus" double arm 250 and 100 gals.
1—Patterson 6' dia. Steel Conical, 15 HP.
5—Steel Powder 50, 225 and 350 cu. ft.
1—10 cu. ft. Ft. "V" Blender, 304 S.S.
1—Eppenbach 1 HP, 304 S.S. Homo Mixer.

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7—Stokes DD2, D53, D3, B2, "R" & "F" Tablet Presses.
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2—Stokes #412G, 412B Vacuum Pumps, motor driven.
8—Wilfley 4" Haveg lined Centrifugal Pumps, motor driven.
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Mikro Pulverizers from Bantam to No. 4. Raymond Impact Mills; Nos. 32, 40, 47.
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Fitzpatrick Comminutator Model K7 in Stainless Steel; 20 HP hi speed motor.
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Shriver 36" JACKETED Cast Iron Filter Press; Seco closure.
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1—Struthers-Wells Single Eff. St. St. 625 sq. ft. vertical tubes.
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1—Patterson Ball Mill, 4' x 5'.
1—Allis-Chalmers Cont. Ball. Mill, 6' x 16'.
3—Pebble Mills; 4'6" x 12', 5' x 8', 6' x 8'.
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4—"Fitz" Mills, St. St., #F, D.

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6—465 gal. St. St. 3' dia. 8'6" deep, 150# WP, 165# jkt. pr.
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3—St. St. T347 13 gal. 1400# test, 50# jkt.
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2—Fletcher Susp. 40" dia. Basket, 1 perf. plain steel, 1 rubber covered imperf.
1—Fletcher 12" dia. St. St. Solid Basket.
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1—Bird 40" x 60" Solid Bowl, T304 S. S.
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2—DeLaval #BUH-3930 Hermetic Clarifiers, Stainless Steel.
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2—Devine Vacuum Shelf Dryers, Size 17, 80 sq. ft. UNUSED.
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6—Double Drum Dryers: 42" x 120"; 42" x 100"; 32" x 52"; 24" x 60"; 22" x 38".
1—Rotary Hot air dryer, 9' x 30', St. St. lined.
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3—Rotary Coolers: 104" x 30'; 104" x 70', 5' x 40'.
1—B & S Rotary Hot Air Dryer, 3' x 15', Everdur (Silicon Bronze).
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1—Buflovak 40" x 40" Vac. Shelf Dryer, 6 shelves
2—Link-Belt Roto-Louvre Dryers, sizes 207-10 and 310-16

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American
AIR COMPRESSOR CORP.
NORTH BERGEN, N. J.
Telephone UNion 5-4848

NEW AND GOOD-AS-NEW EQUIPMENT

1—Stainless Tank #430 Chrome, vert. 7'x10' deep.
20—Jacketed Kettles—Stainless, Copper, Aluminum.
1—Day Mixer, steam jacketed, 50 gal. Sigma Blade.
1—Sperry Filter Press 42", open del. 40-plates, 41-frames.
60—New Pressure Cookers, 18"x18" & 24"x28".
1—New Glass Nash Centrifugal Pump, 160 gpm.
1—New Nash Vacuum Pump Type AL-572.
1—Buffalo Jacketed Impregnating Tank 42"x52".
1—Stedman Distintegrator size 40-6.
1—Jeffrey Vibrating Conveyor 12" x 8", 15' lg.
1—Nash Air Compressor, Type AL 823.
1—Manton Gaulin Stainless Homogenizer 125 gph.
1—I&R Vacuum Pump, 5 H.P., 60'.
4—Heat Exchangers, 12" dia. 11' lg., 43 steel tubes.
1—Raymond 8" Hammer Mill, like new.
2—Louisville Steam Tube Dryers 6' x 35'.
1—New Louisville Continuous Filtering Machine.
2—Stainless Steel Steam Jacketed Readco Mixers.
1—#316 Stainless Reactor, 265 gals. cap., jacketed.
Abbe Pebble & Tube Mill, 5'x22'—Buhrstone Lined.
1—Patterson Ball Mill, porcelain lined 17"x27".
1—Patterson Ball Mill, 42x36 jacketed.
2—Large Steam Jacketed Horizontal Mixers.
2—Ribbon Type Mixers, 50 & 90 cu. ft.—like new.
2—Steel Tanks 90,000 gals., ea. vert. welded const.
2—Ball & Jewell #2 Cutters with 75 H.P. Motors.
1—J. H. Day 3-roll Mill 9x16.
3—3,000 gal. Jacketed Kettles with Turbo Agitators.
1—#10 Day 300 gal. Jacketed Sigma Blade Mixer.
1—New Yeas Exc. 60' with Cupro Nickel Tubes.
1—Scarlet Stainless Filter Model 33-B-9.
3—4'x8' Shaker Screens.
6—W & P Mixers, jacketed, heavy duty, sigma blade 300 gal. with hydraulic dumpers.
3—Baker-Perkins Mixers—same as above.
2—Sperry 30" Filters, clsd. del., 39-pl. 40-fr.

H. LOEB & SON

4643 LANCASTER AVE., PHILADELPHIA 31, PA.

MILLS, HAMMER, ¾ HP Raymond, 7½ HP Quaker City, 10 HP Mikro 2 SI, 25 HP Williams AKB, 50 HP Jeffrey, 75 HP Gruendler, 100 HP & 150 HP Jeffrey, 350 HP Penna. SXT 13

MILLS, PEBBLE, 18 x 24, 24 x 24, 30 x 24, 40 x 48, 60 x 48 (new porcelain) 72 x 60, 6' x 8', 6' x 9' Buhrstone

SCREENS, 40 x 84 Retex and Reball, 3' x 5' & 3' x 10' double Tyler Hummer, 4' x 10' (2) Cedar Rapids, 5 x 12 Robins Eliptex (2½)

TANKS, 5' x 13' cone bottom (125# cede), 2 vertical 10' x 28' (16,000 gal.)

CRUSHERS, JAR, 7½ x 13 Champ, 15 x 24 Traylor, 15 x 24 Diamond portable

CRUSHERS, ROLL, 24 x 24 L.B., & 30 x 30 Jeffrey single, 18 x 24, 30 x 16, 36 x 30 smooth

ROTARY DRYERS, 24" x 20', 44" x 25', 48" x 35', 60" x 45', w/accessories

MILLS, BALL, 8' x 36", 8' x 48" Hardinge, Conical, 5' x 20', 6/6" x 21' tube

FORK LIFTS, 2000# Hyster 12' lift, 6500# Yale 8' lift, w/cab, pneumatics, gasoline

BAG PACKERS, St. Regis 160LS (new) single spout for 100# valve bags complete w/motor

COMPRESSORS, AIR, 750 CFM 100 PSI, 150 HP slip ring motor

LAWLER COMPANY

Durham Ave. Liberty 9-0245 Metuchen, N. J.

PLAN for your FUTURE!

USE LOW COST, HIGH QUALITY

GELB

PROCESSING EQUIPMENT

3—Robinson Type 316 Stainless Steel Sigma Type, Jacketed, Heavy Duty Continuous Mixers, complete with 60 HP drive and motor, 400 gal. cap.

1—Leader Stainless Steel Jacketed Ribbon Blender, with 15 HP motor and drive.

1—Process Engineers Stainless Steel Jacketed Ribbon Blender, 2'6" x 9'6", complete with 10 HP drive and motor.

2—Readco Stainless Ribbon Blenders, 285 cu. ft. capacity with 30 HP motor and drive. Capacity 2120 gal.



DRYERS & KILNS:

1—Louisville Experimental Rotary Dryer, 12" x 7'6"

2—Ruggles Coles Rotary Dryers, 4' x 20' and 4' x 30'

1—Trayler Rotary Dryer, 4' x 40'

1—Bartlett & Snow Rotary Dryer, 4'6" x 36'6"

8—Stokes Single Door Vacuum Shelf Dryers, 6 and 4 shelves

2—Buflovak Double Drum Dryers, 42" x 120"

1—Stokes Double Drum Dryer, 5' x 12'

1—F. L. Smidth Rotary Kiln, 8'2" x 132', Complete

4—Rotary Dryers, 6'4½" dia. x 45' long, Complete

1—Rotary Kiln, 2' x 14', Complete

FILTERS:

2—Impco Rotary Vacuum Filters, 5' x 4', with vari-speed motor, drive and vacuum pumps, complete

2—Feinc Stainless Steel Rotary String Filters, Size 5' x 6'

2—Niagara Stainless Steel Filters, Models 510-38 and 26-60-4

1—Bird Continuous Centrifugal Filter, Model 24" x 38"

1—Sweetland #7 Filter with 20 steel leaves

10—Sweetland #12 Filters with 72 Stainless Steel Leaves

1—Feinc Stainless Steel Rotary String Filter, 3'x3', New

AUTOCLAVES, KETTLES AND TANKS:

1—Combustion Engineers Steel Jacketed Autoclave, 1600 gal., complete with Agitator and Drive. W. P. Jacket 150#, W. P. Shell: 600# ASME Code.

1—Buflovak Stainless Steel Jacketed Reactor, 250 gals.

1—Alloy Fabricators Stainless Steel Jacketed 250 gal. Kettle

1—Pfaudler Glass-lined, Series R, Jacketed Kettle, 500 gals.

2—Steel Vertical Rubber-lined Storage Tanks, 1000 gals. ea. NEW

2—Steel Pressure Tanks, 30,000 gal., 200# W. P. ASME Code

1—Chicago Bridge and Iron Works Steel Pressure Tank, 18,000 gal. 80# W. P., ASME Code

CENTRIFUGALS:

1—Baker Perkins Ter Meer, Type 316 Stainless Steel Centrifugal, Model HS 24"

1—AT&M Link Suspended Type Centrifuge with 28" Stainless Steel Perforate Basket

2—Sharples Type 316 Stainless Steel Centrifuges, Model #D-2

1—Tolhurst Rubber lined Centrifuge, 20" basket, base bearing type.

1—Sharples C20 Stainless Steel Centrifuge

MISCELLANEOUS:

1—E. B Badger Steel Bubble Cap Column, 24" x 24', with 15 trays

1—E. B. Badger Stainless Steel Bubble Cap Column, 3' x 7', with 10 trays.

1—Vulcan Type 316 Stainless Steel Bubble Cap Column, 3' x 31', with 30 trays

5—Davis Engr. Type 347 Stainless Steel Heat Exchangers, 120 sq. ft. ea. NEW

5—Davis Engineering Type 347 Stainless Steel Heat Exchangers, 200 sq. ft. ea. NEW

1—Komarek Greaves Briquetting Machine with 50 HP motor

1—Ingersoll Rand Air Compressor, Type PRE-2 with 300 HP motor

2—Howe 40 cu ft Rubber Covered Ribbon Blender NEW

15—Bump Pumps, Model 30, Type 316 Stainless Steel NEW

2—Cyclone Collectors, 40" with 12" motorized Star valves

1—Sterling Speedtrol with 7½ HP Explosion proof motor NEW

1—Stokes Stainless Steel Granulator, #43A

1—Baker Perkins Stainless Steel Jacketed Vacuum Dispersion Mixer, 100 gal. cap., 60 HP motor.

1—Link Belt Stainless Steel Roto Louvre Dryer, Model 207-14

1—Sparkler Stainless Steel Jacketed Filter, Model 1458

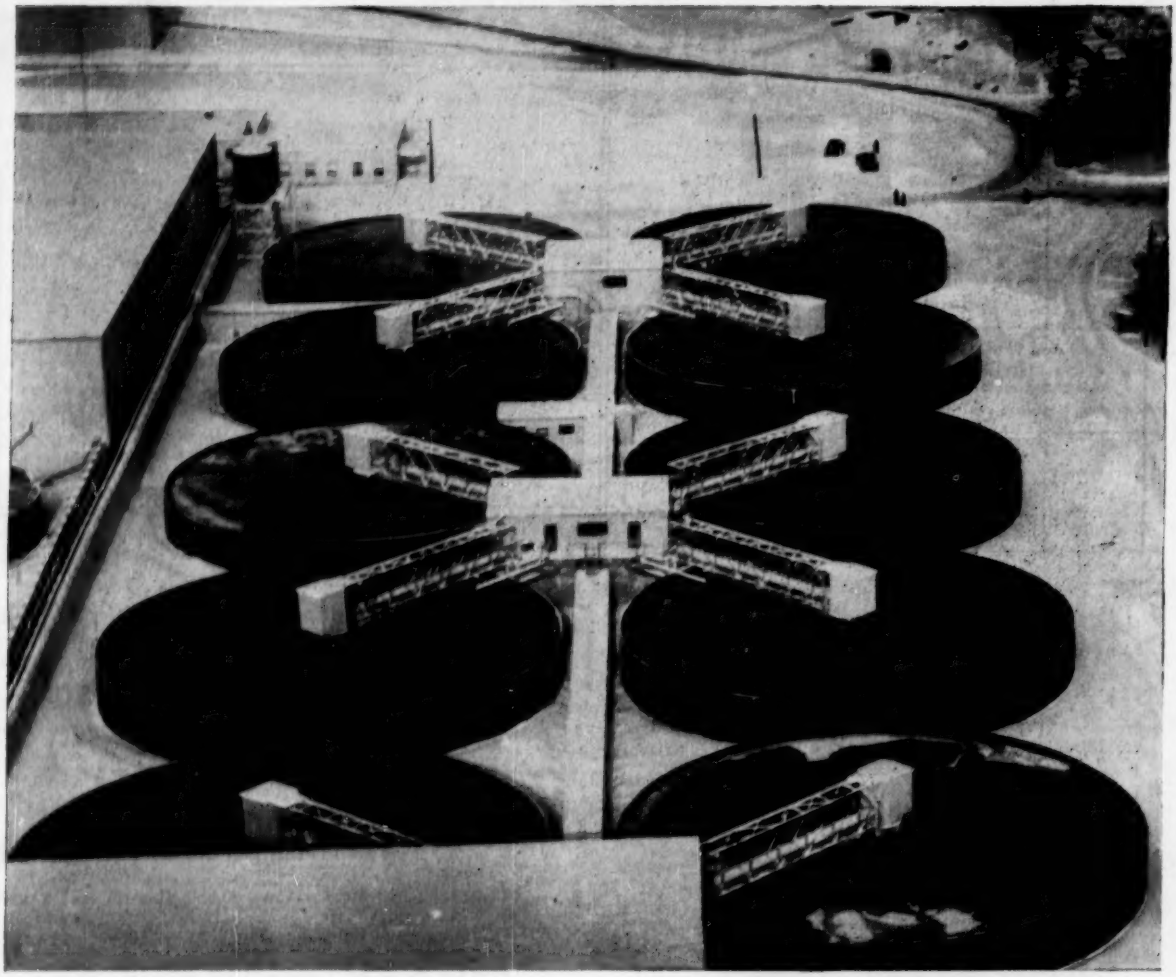
Established 1886

R. GELB & SONS, Inc.,

CHEMICAL, RUBBER, OIL, PLASTIC and FOOD PROCESSING MACHINERY

U.S. HIGHWAY No. 22, UNION, N.J. · MUrdock 6-4900

B.F.Goodrich report:



Uranium gets an acid bath

B. F. Goodrich improvements in rubber brought extra savings

Problem: Those steel tanks are part of the above-ground operation of the world's largest uranium mines, located in Ontario, Canada. Over 100 huge tanks are used in the process of separating uranium from the ore. But the acids used are so corrosive they would eat holes in the tanks, pipes, fittings and valves.

What was done: B.F.Goodrich engineers recommended rubber lining by the exclusive B.F.Goodrich Vulcalock process. The rubber lining is locked to the metal so strongly and tightly that it practically becomes a part of the metal. A square inch of it can stand a 500 pound tug without breaking loose. Even if the acid-proof rubber is accidentally punctured, the Vulcalock bond confines the damage to a small area where it can easily be repaired.

Extra benefits: This installation was lined in the field by specially-trained B.F.Goodrich craftsmen. It had to be finished quickly. Working at top speed, they lined over 100 tanks and miles of piping with 9½ acres of rubber.

Why specify B. F. Goodrich: Our tank-lining craftsmen have had a wide variety of experience in rubber-lining equipment in the field. Many of these jobs were big, spectacular; others were smaller, but all were handled efficiently due to the skill and ability gained by years of doing field work under difficult conditions. It's this combination of expert engineering ability, proven construction features, and skilled craftsmanship that insures the economy and efficiency of every B.F.Goodrich rubber-lined installation. *B.F.Goodrich Industrial Products Co., Dept. M-167, Akron 18, Ohio, or Tuscaloosa, Alabama.*

B.F.Goodrich
INDUSTRIAL PRODUCTS



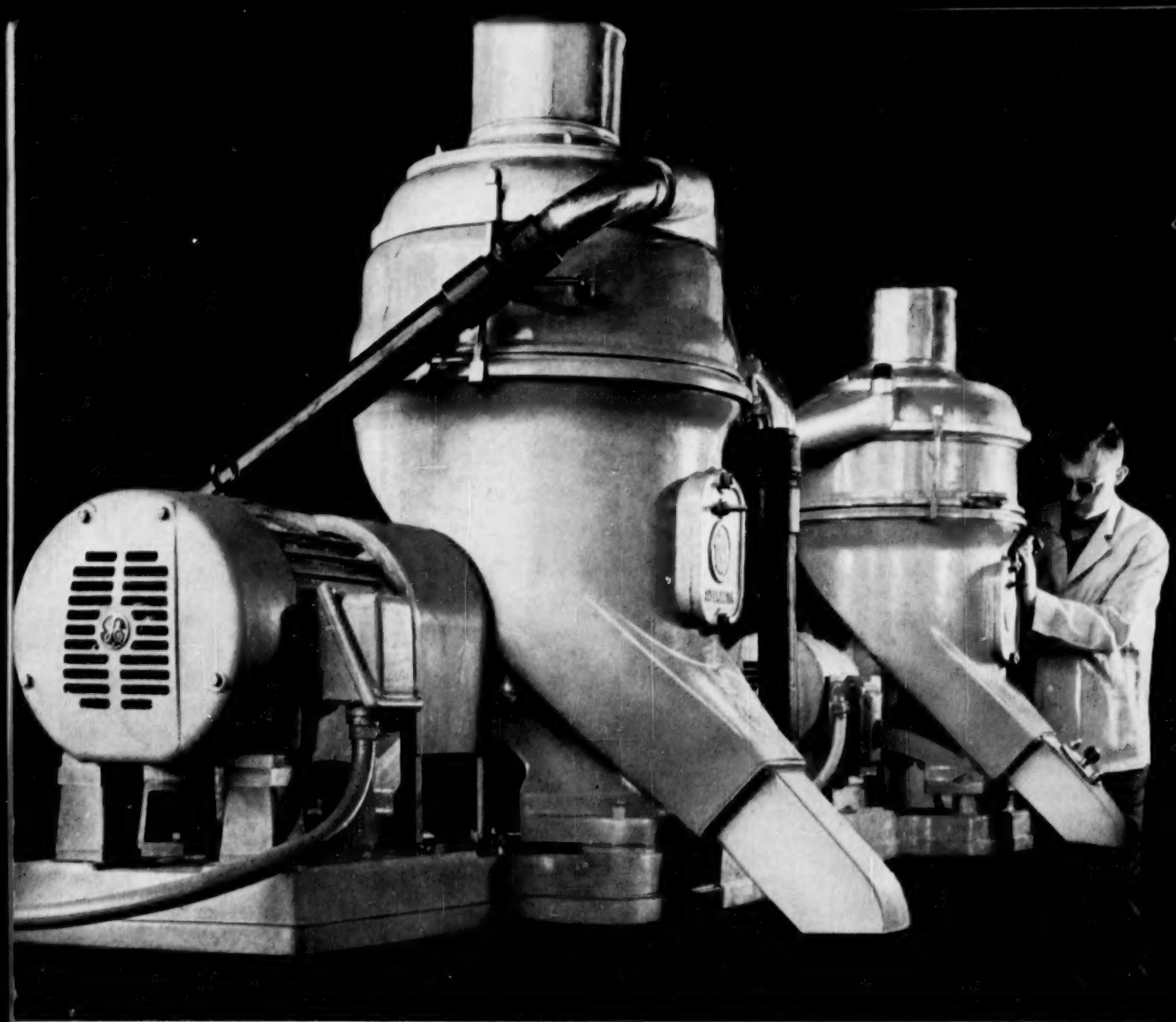
TWO WAYS...with Master Unibrakes

STOP-HOLD—Master Type M Magnetic Unibrake Motors. For quick, controlled stopping—especially when you want to hold the load. Spring-setting magnetic release brakes of the friction disc type combine with motor in a compact, integral unit. Sizes—⅛ to 150 H.P.

ROLLING STOP—Master Type D Dynamic Unibrake Motors. Braking is obtained with a unique, patented brake winding superimposed on the stator winding. Simple, compact, with no DC current required, the brake has no moving parts. There is nothing to wear or adjust—braking torque repeats consistently. Particularly recommended for automatic applications which do not require static holding. Sizes up to 30 H.P.

MASTER GEARMOTORS and variable speed drives can be supplied with integrated Unibrakes too. See Master for the perfect power drive for you.

MASTER UNIBRAKE MOTORS



Now... separate slurries up to 35% solids by volume without stopping for sludge removal!

You can run a Titan Superjector for as long as a month at full speed without a single shutdown for cleaning.

This centrifuge periodically ejects sludge *automatically* while running at full speed, cleans itself completely in ten seconds or less.

With this new Pfaudler centrifuge you can concentrate solids up to 40% dry weight. You can get clear effluents at the same time.

It discharges mixed solid particles up to ⅛" diameter, removes solids both heavier and lighter than infeed.

There are settling vanes within the Superjector to curtail turbulence and shear of solids. You can adapt infeed holes and disc spacers closely to your product by selecting from the wide range of discs available from stock.

Lower running cost

The Titan Superjector periodically and *automatically* rids itself of sludge through a series of ¼" by 5" slots on the bowl circumference. The bowl's own centrifugal force builds up the hydrostatic pressure which opens the slots.

Since there is no braking effect from continuous discharge of solids, power consumption is exceptionally low.

The Titan Superjector has proved its value time and time again in such service as separating liquids from animal intestines for pharmaceuticals, refining vegetable oils, purifying waste lubricants, extracting fish oils, recovering yeast and cereal proteins, and a great number of other uses.

For further information on its unique design and operation, write for Bulletin 946.

THE PFAUDLER CO.
ROCHESTER 3, N. Y.

Specialists in Corrosioneering

See pages 56 & 57 of this issue also.